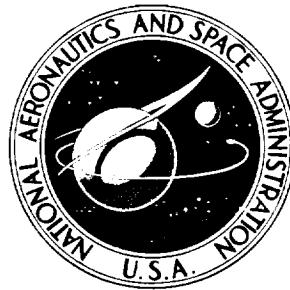


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PROTON AND DEUTERON DOUBLE DIFFERENTIAL  
CROSS SECTIONS AT ANGLES FROM  $10^\circ$  TO  $60^\circ$   
FROM Be, C, Al, Fe, Cu, Ge, W, AND Pb  
UNDER 558-MeV-PROTON IRRADIATION

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16. Abstract			
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UNDER 558-MeV-PROTON IRRADIATION

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SUMMARY

The double differential cross sections (mb/sr-MeV) for the production of protons and deuterons from targets of Be, C, Al, Fe, Cu, Ge, W, and Pb have been obtained at laboratory angles of scatter of  $10^{\circ}$ ,  $20^{\circ}$ ,  $30^{\circ}$ ,  $40^{\circ}$ ,  $50^{\circ}$ , and  $60^{\circ}$  for 558-MeV incident protons. A quasi-elastic peak is discernible in the cross sections up to approximately  $40^{\circ}$  for all targets used. The position of the peak corresponds closely to the theoretical predictions for proton-proton elastic scattering at an incident proton energy of 558 MeV.

The mean ratio of deuteron to proton energy-integrated cross sections (mb/sr) is  $0.056 \pm 0.008$ . The dependence of energy-integrated cross sections (mb/sr) for both protons and deuterons on target mass number  $A$  varies from  $A^{1/3}$  at an angle of scatter of  $10^{\circ}$  to  $A^{2/3}$  above approximately  $30^{\circ}$ .

The ratio of energy-integrated deuteron cross sections (mb/sr) for quasi-elastic processes to deuteron cross sections for reactions yielding a deuteron-pi-meson pair is approximately 10 percent. The shape of the deuteron cross-section spectra at angles above  $20^{\circ}$  is generally better described by an exponential law in the kinetic energy of the deuteron in contrast to a power law reported for deuterons produced in the interaction of 300-MeV protons with nuclei.

INTRODUCTION

This report contains experimental cross sections from a research program to study the particle types emitted from materials under proton irradiation at the NASA Space Radiation Effects Laboratory (SREL). This program was designed to supplement the experimental space shielding studies performed by the Oak Ridge National Laboratory (ORNL) and partially sponsored by NASA. (See refs. 1 to 5.) The principal motivation for the ORNL and NASA in-house experimental studies was to obtain cross-section data to determine the shield effectiveness of spacecraft structural materials against the space

radiation environment and to identify biologically important secondary particles produced in nuclear reactions.

In the interaction of high-energy particles with nuclei of materials or biological systems, a large number of secondary particles are produced which interact with other nuclei to produce additional secondary particles. To understand the extent of particle buildup, the particle types, numbers, angular distributions, and energy spectra must be measured. The data of this report consist of secondary proton and deuteron cross sections differential in energy and angle for targets bombarded by 558-MeV protons at various scattering angles.

At the beginning of this program, little experimental proton-nucleus interaction data were available at proton energies between 300 and 1000 MeV. For 300-MeV incident protons, some proton, deuteron, and triton cross-section data had been obtained at angles of  $26^\circ$ ,  $40^\circ$ , and  $60^\circ$  for targets of Li, C, Al, Cu, Cd, Pb, and U. (See ref. 6.) In Russia, at the Joint Institute for Nuclear Research in Dubna, one experiment had been performed to measure the proton secondaries emitted at laboratory angles of  $7^\circ$ ,  $12.2^\circ$ ,  $18^\circ$ ,  $24^\circ$ , and  $30^\circ$  from targets of Be, C, Cu, and U under 660-MeV-proton irradiation. (See ref. 7.) However, the present program was designed to measure both secondary protons and deuterons at angles up to  $60^\circ$  to assess the contribution of deuterons to the total radiation dose within a vehicle in the space environment. During the course of these experiments at SREL, researchers at the Dubna synchrocyclotron reported their additional measurements of secondary protons and heavier particles up to angles of  $16^\circ$  from materials irradiated with approximately 660-MeV protons. (See refs. 8 to 11.)

Three sets of scattering data were obtained at the SREL synchrocyclotron. The first set of data, which is the basis of this report, consisted of the energy distributions of secondary protons and deuterons from targets of Be, C, Al, Fe, Cu, Ge, W, and Pb irradiated with 558-MeV protons at laboratory angles of  $10^\circ$ ,  $20^\circ$ ,  $30^\circ$ ,  $40^\circ$ ,  $50^\circ$ , and  $60^\circ$ . The second data set was obtained by using 558-MeV protons on thin targets (approximately  $2 \text{ g/cm}^2$ ) of Be, C, Mg, Al, Ti, Fe, Ni, Cu, Zr, Ag, Sn, Nd, W, Au, and Pb at angles of  $10^\circ$ ,  $20^\circ$ ,  $30^\circ$ ,  $40^\circ$ , and  $50^\circ$ . In the third experiment, thin targets ( $1$  to  $2 \text{ g/cm}^2$ ) of Be, Al, Fe, Ag, and Au were bombarded by 700-MeV alpha particles, and the energy distributions of secondary protons, deuterons, tritons, helium-3 particles, and helium-4 particles were obtained at angles of  $6^\circ$ ,  $10^\circ$ ,  $15^\circ$ ,  $20^\circ$ ,  $30^\circ$ , and  $40^\circ$ .

In this report the differential cross sections derived from the first set of measurements are given for secondary proton and deuteron production. The cross sections are presented in tabular and graphic form.

## SYMBOLS

A	mass number
a,b	constants
E	scattered-particle kinetic energy, MeV
$E_0$	incident proton kinetic energy, MeV
m,n	constants
$m_p$	proton rest mass, 938.256 MeV
$\alpha, \beta$	constants
$\theta$	laboratory angle of scatter, deg
$\bar{\sigma}$	cross section, mb
$\Omega$	solid angle, sr

## EXPERIMENTAL CONDITIONS

The proton beam from the synchrocyclotron at the NASA Space Radiation Effects Laboratory (SREL) was transported to the proton target area by a 25-element magnetic system. (See fig. 1.) The beam spot at the target was circular in cross section with a diameter of 2.6 cm. The divergence of the beam measured over a 6-m length was less than 0.003 rad. The proton beam energy was measured to be  $558 \pm 7$  MeV by using a focused Čerenkov radiation detection system. (See ref. 12.) The extracted proton beam characteristics of the SREL synchrocyclotron are given in reference 13. In brief, the proton beam had macrobursts at frequency  $F \approx 55$  Hz of duration  $T = 20$  to  $110 \mu\text{sec}$  and microbursts of approximately  $t = 8$  nsec at a frequency  $f \approx 17.5$  MHz which gave a duty cycle of  $FTf = 1.5 \times 10^{-4}$  to  $6.2 \times 10^{-4} \text{ Hz}^2 \cdot \text{sec}^2$ . The incident proton beam current was measured with two identical helium-filled ion chambers (ref. 14). The ion chambers were calibrated against the SREL Faraday cup (ref. 15).

Secondary charged particles from the target were detected with a two-parameter scintillation spectrometer system shown in figure 2 and explained in detail in reference 13. The system measured both the time of flight of secondary charged particles over a 488-cm flight path and the energy deposited in a plastic scintillator, 12.7 cm in diameter and 30.48 cm long. The time resolution of the system was 0.39 nsec, which gave a calculated energy resolution of 7.75 percent at 558 MeV and 1.6 percent at 50 MeV for protons. The energy resolution of the large scintillator was approximately 9 percent up to 200 MeV for protons. The system clearly separated protons from deuterons up to a deuteron energy of approximately 370 MeV.

In order to eliminate, as far as possible, the effects of beam pileup in the detection system, the average proton beam current for a given target and angle was adjusted to give an average system count rate between 50 and 60 counts per second, or approximately 1 count per macroburst. The arrangement and performance of the detector system are given in reference 13.

The thicknesses of the targets used are listed in table 1 along with the angles. All targets were commercially available and were of natural isotopic abundance. The targets were approximately 10 cm square or larger with the exception of the beryllium and germanium targets which were 5.08 cm by 7.62 cm and 3.8 cm by 5.2 cm, respectively. All targets were of uniform thickness.

#### DATA ANALYSIS

Details of data analysis and correction to the experimental data are given in reference 13. The largest correction to the data involved a calculation of the multiple scattering from the first set of detectors shown in figure 2. The data were also corrected for energy loss through the spectrometer. Both corrections were obtained through Monte Carlo calculations. The uncertainty in the cross-section values varies with particle energy from  $\pm 9.3$  percent at 50 MeV to  $\pm 11.4$  percent at 558 MeV for protons, and from  $\pm 8.0$  percent at 90 MeV to  $\pm 8.3$  percent at 350 MeV for deuterons.

#### RESULTS AND DISCUSSION

The proton and deuteron double differential cross sections are shown in figures 3 to 10 as composite graphs for each target element. The most prominent feature of the proton cross sections is the quasi-elastic scattering peak which is discernible up to  $30^\circ$  to  $40^\circ$ . In figure 11 the energy of the quasi-elastic peak is plotted as a function of laboratory angle of scatter with aluminum as the target. The solid curve represents relativistic

elastic proton-proton scattering for incident proton energy  $E_0$  of 558 MeV. The relation is

$$E = \frac{E_0 \cos^2 \theta}{1 + \frac{E_0}{2m_p} \sin^2 \theta}$$

where  $\theta$  is laboratory angle of scatter,  $m_p$  is the rest mass of the proton (938.256 MeV), and  $E$  is the kinetic energy of the proton scattered at angle  $\theta$ .

The excellent agreement of the data with free proton-proton scattering theory indicates that the incident protons, after suffering one collision within the nucleus, can then escape without further interactions. One is then led to the conclusion that, at an incident energy of 558 MeV and forward scattering angles, the observed protons arise from proton-nucleon collisions on or near the nuclear periphery.

In figure 12 the widths of the quasi-elastic peaks, expressed as the peak full width at half maximum in MeV, are given as a function of target mass number. The large uncertainty in the widths at  $10^\circ$  is related to the energy resolution of the detection system. The data at  $20^\circ$  and  $30^\circ$  indicate a slight increase with increasing atomic weight; however, the data at  $10^\circ$  are too poor to draw conclusions. The solid lines are used as a guide only.

The continuum spectra below the quasi-elastic peak for beryllium (fig. 3(a)) and carbon (fig. 4(a)) are assumed to arise predominantly from the inelastic scattering processes of pi-meson production with some admixture of multiple scattering processes. Note that the rate of increase in the cross section with decreasing energy is relatively slow for both elements from  $10^\circ$  to  $60^\circ$ . This indicates a minor degree of thermalization via multiple scattering within these light nuclei. However, in aluminum (fig. 5(a)) and heavier nuclei the increasing rate of growth of the continuum spectra with the size of the nucleus indicates the increasing importance of multiple scattering processes.

The energy-integrated cross sections for the emission of secondary protons as a function of laboratory angle of scatter are given in table 2 and the same data are shown in figure 13. The values of  $d\sigma/d\Omega$  smoothly decrease with increasing emission angle.

The approximate dependence of  $d\sigma/d\Omega$  on the mass number  $A$  was assumed to be  $\alpha A^\beta$  where  $\alpha$  and  $\beta$  are constants. The values of the constants were obtained by a least-squares fit to the data as shown in figure 14. These values of  $\alpha$  and  $\beta$  are tabulated in table 3 along with similar values from reference 7. In figure 15 the data of table 3 are plotted as a function of laboratory angle of scatter to show the dependence of

the energy-integrated cross sections on the exponent  $\beta$ . The exponential dependence on mass number is nearly the same for angles from  $20^\circ$  to  $40^\circ$  for both sets of data. The values of  $\beta$  at  $10^\circ$  are close to  $1/3$  which indicates that the cross section for quasi-free scattering is proportional to the nuclear circumference. The value of  $\beta$  increases with increasing angle to approximately  $2/3$  near  $40^\circ$  and remains nearly constant at higher angles. The approximate  $\beta = 2/3$  dependence of the cross sections on the mass number indicates that the secondary particles at higher angles are produced by interactions within the nucleus.

The energy-integrated deuteron cross sections are listed in table 4 and plotted as a function of laboratory angle of scatter in figure 16. The same dependence on mass number,  $\alpha A^\beta$ , was assumed for the deuteron cross sections, and  $\alpha$  and  $\beta$  were obtained by a least-squares fit to the data as shown in figure 17. The values of  $\alpha$  and  $\beta$  from this experiment and values of  $\beta$  from reference 11 are given in table 5. Values of  $\beta$  are plotted as a function of laboratory angle of scatter in figure 18. Again, the exponential dependence on mass number agrees with the present data. The variation of  $\beta$  with laboratory angle appears to be the same for both protons (fig. 15) and deuterons up to approximately  $25^\circ$ ; however, the value of  $\beta$  for deuterons appears to increase with increasing angle, whereas the proton data indicate a nearly constant value of  $\beta$  above  $40^\circ$ . The deuteron cross sections used to obtain values of  $\beta$  in reference 11 and for the data of this experiment correspond to proton-nucleus interactions which are assumed to produce a deuteron-pi-meson pair.

The quasi-elastic scattering of protons by two-nucleon clusters to produce fast deuterons is shown in figure 19. This deuteron energy spectrum at a laboratory angle of scatter of  $10^\circ$  for a beryllium target contains a small peak close to the energy of elastically scattered deuterons (493 MeV). In table 6 the cross sections for the quasi-elastic production of deuterons obtained in this experiment at  $10^\circ$  are listed along with data from reference 11 for deuterons produced at  $9.5^\circ$ . The cross-section values obtained in the two experiments on the same elements are the same within the quoted errors. The ratio of deuteron cross sections for quasi-elastic processes to cross sections for deuterons from reactions yielding a deuteron-pi-meson pair is approximately 10 percent which is also in agreement with the results of reference 11.

In table 7 cross sections of this experiment are listed with data from other experiments on the same or similar targets with incident proton energies from 160 MeV to 660 Mev. In every case where data are available at the same angle for the same target material, the results at 660 MeV are higher than the data at 558 MeV, and the cross sections at 450 MeV are always less than those at 558 MeV. In figure 20 the available cross sections for aluminum, carbon, and beryllium at a laboratory angle of  $30^\circ$  are plotted as a function of incident proton energy. From these data the cross sections for

secondary proton production go through a shallow minimum for incident proton energies near 400 MeV and then increase rapidly with increasing incident energy.

In table 8 the ratio of deuteron to proton energy-integrated cross sections (mb/sr) is given for each element and angle used in this experiment. The ratio varies from a minimum of 3.5 percent for beryllium at  $60^{\circ}$  to a maximum of 7.6 percent for tungsten at  $50^{\circ}$ . The average of all ratios is  $0.056 \pm 0.008$ . With the exception of beryllium and aluminum the ratio goes through a broad maximum near  $30^{\circ}$ , and, in each case, the value of the ratio is less at  $60^{\circ}$  than at  $10^{\circ}$ . In addition, the ratio at each angle increases slightly with atomic weight.

The deuteron production observed in reference 6 from targets bombarded by 300-MeV protons was attributed to an incident pickup process where the energy dependence of the pickup probability was assumed to vary as a power law in the kinetic energy of the scattered nucleon,  $mE^{-n}$ . From their data the authors of reference 6 concluded that the energy dependence of the pickup probability was best given by  $E^{-2}$  or  $E^{-3}$  at angles of  $26^{\circ}$ ,  $40^{\circ}$ , and  $60^{\circ}$ . By way of comparison, the deuteron cross-section data of this report show that the exponent  $n$  varies with angle from approximately 1.1 at  $20^{\circ}$  to 3.1 at  $60^{\circ}$ . However, the data at angles above  $20^{\circ}$  are not generally well matched by a power-law curve as shown in figure 21. The exponential curves shown in the same figure have the form  $ae^{-E/b}$  where  $a$  and  $b$  are constants. For the data shown the exponential curves give superior fits to the cross-section data. The parameters  $n$  and  $b$  for the power-law and exponential curves are given in table 9 for all proton and deuteron data obtained in this study. The curve associated with a footnoted entry gives a superior fit to the data on the basis of the following criteria. The goodness-of-fit parameter is for the power-law curve,

$$X_p = \sum_i \frac{\left[ \left( \frac{d^2\sigma}{dE d\Omega} \right)_i - mE_i^{-n} \right]^2}{mE_i^{-n}}$$

and for the exponential curve,

$$X_e = \sum_i \frac{\left[ \left( \frac{d^2\sigma}{dE d\Omega} \right)_i - ae^{-E_i/b} \right]^2}{ae^{-E_i/b}}$$

where the summation is performed over the cross-section data for a particular angle and target. The curve that more closely matches the data has the smallest value of  $X$ .

Because of scatter in the data, the curve that yields a value of  $X$  at least a factor of 2 smaller than the value for the other curve is considered a superior fit to the data. If the difference between the two values of  $X$  is less than a factor of 2, then both curves are considered equally good fits to the data.

As indicated in table 9(a), the proton data below the quasi-elastic peak can generally be described by either a power-law curve or an exponential curve. However, the deuteron data in table 9(b) for aluminum and heavier elements are generally better described by an exponential curve, decreasing with increasing particle energy. The disagreement between the shapes of the deuteron spectra in this report and those of reference 6 is probably the result of deuterons produced in the pi-meson production process.

The double differential cross sections (mb/sr-Mev) for the production of secondary protons and deuterons from targets of Be, C, Al, Fe, Cu, Ge, W, and Pb are given in tabular and graphic form as follows:

	Table	Figure
<b>Proton cross sections:</b>		
Beryllium (Be) . . . . .	10	3(a)
Carbon (C) . . . . .	11	4(a)
Aluminum (Al) . . . . .	12	5(a)
Iron (Fe) . . . . .	13	6(a)
Copper (Cu) . . . . .	14	7(a)
Germanium (Ge) . . . . .	15	8(a)
Tungsten (W) . . . . .	16	9(a)
Lead (Pb) . . . . .	17	10(a)
<b>Deuteron cross sections:</b>		
Beryllium (Be) . . . . .	18	3(b)
Carbon (C) . . . . .	19	4(b)
Aluminum (Al) . . . . .	20	5(b)
Iron (Fe) . . . . .	21	6(b)
Copper (Cu) . . . . .	22	7(b)
Germanium (Ge) . . . . .	23	8(b)
Tungsten (W) . . . . .	24	9(b)
Lead (Pb) . . . . .	25	10(b)

In the proton data tables, cross-section values greater than zero are shown at energies greater than the incident proton energy of 558 MeV. This apparent discrepancy is due to the large uncertainty in the secondary proton energy at higher energies and, to a much smaller extent, to pi-meson contamination of the high-energy proton spectra.

## SUMMARY OF RESULTS

Double differential cross sections (mb/sr-MeV) for the production of protons and deuterons from Be, C, Al, Fe, Cu, Ge, Pb, and W have been obtained at laboratory angles of scatter of  $10^\circ$ ,  $20^\circ$ ,  $30^\circ$ ,  $40^\circ$ ,  $50^\circ$ , and  $60^\circ$  for 558-MeV incident protons.

The following results have been obtained from this investigation:

1. A quasi-elastic proton peak is discernible in the cross sections up to approximately  $40^\circ$  for all elements used. If the energy corresponding to the quasi-elastic peak is plotted as a function of angle of scatter, the points lie almost exactly on the theoretical curve for proton-proton elastic scattering at an incident proton energy of 558 MeV.
2. A comparison of proton and deuteron energy-integrated cross sections obtained at 660 MeV with those of this report shows that both sets of data give nearly the same dependence on the mass number of the target element. The data indicate that at  $10^\circ$  the secondary proton and deuteron spectra arise primarily from interactions on the nuclear periphery. At larger angles the dependence of the cross section (mb/sr) on the target mass number  $A$  changes rapidly from a  $1/3$  power of  $A$  to a  $2/3$  power of  $A$ .
3. The ratio of deuteron energy-integrated cross sections (mb/sr) for quasi-elastic processes to deuteron cross sections for reactions yielding a deuteron-pi-meson pair is approximately 10 percent.
4. The mean ratio of the deuteron to proton energy-integrated cross sections (mb/sr) is  $0.056 \pm 0.008$ . The individual ratios show a weak dependence on the atomic weight.
5. The shape of the deuteron cross-section spectra at angles of scatter above  $20^\circ$  is generally better described by an exponential law in the kinetic energy of the deuteron in contrast to a power law reported for deuterons produced in the interaction of 300-MeV protons with nuclei.

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TABLE 1.- PARAMETERS OF CHARGED-PARTICLE MEASUREMENTS

Element	Thickness, g/cm <sup>2</sup>	Angle of scatter, deg (a)
Beryllium (Be)	2.35	10, 20, 30, 50, 60
Carbon (C)	.95	10, 20, 30, 40, 50, 60
Aluminum (Al)	1.82	10, 20, 30, 40, 50, 60
Iron (Fe)	3.77	10, 20, 30, 40, 50, 60
Copper (Cu)	2.79	10, 20, 30, 40, 50, 60
Germanium (Ge)	5.26	10, 20, 30, 40
Tungsten (W)	3.05	10, 20, 30, 40, 50, 60
Lead (Pb)	3.91	10, 20, 30, 40, 50, 60

<sup>a</sup>Angles are measured between the incident proton beam center line and the spectrometer axis. The beam, target, and spectrometer axes are in the same plane.

TABLE 2.- SUMMARY OF ENERGY-INTEGRATED PROTON CROSS SECTIONS

$\theta$ , deg	d $\sigma$ /d $\Omega$ , mb/sr, for -						W
	Be	C	Al	Fe	Cu	Ge	
10	365.6 ± 25.59	422.5 ± 29.57	455.4 ± 31.87	713.7 ± 49.95	845.5 ± 59.18	798.8 ± 55.91	1130.0 ± 79.10
20	122.4 ± 8.56	136.5 ± 9.55	236.0 ± 16.52	347.2 ± 24.30	381.9 ± 26.73	351.1 ± 24.57	608.0 ± 42.56
30	64.7 ± 4.53	80.4 ± 5.62	146.3 ± 10.24	204.6 ± 14.32	239.4 ± 16.75	232.1 ± 16.24	447.6 ± 31.33
40		57.5 ± 4.02	108.1 ± 7.56	181.4 ± 12.69	204.9 ± 14.34	186.8 ± 13.07	340.1 ± 23.80
50	36.6 ± 2.56	47.9 ± 3.35	86.2 ± 6.03	133.7 ± 9.35	151.2 ± 10.58		242.7 ± 16.98
60	19.9 ± 1.39	31.9 ± 2.23	57.9 ± 4.05	89.1 ± 6.24			267.5 ± 18.72
							191.7 ± 13.41
							186.3 ± 13.04

TABLE 3.- CONSTANTS OF EQUATION  $d\sigma/d\Omega = \alpha A^\beta$  FOR PROTONS

$\theta$ , deg	Présent data		Reference 7	
	$\alpha$	$\beta$	$\alpha$	$\beta$
10	154	0.38		
18			61.2	0.53
20	39	.53		
24			36.2	.58
30	18	.61	21.2	.67
40	13	.63	12.0	.71
50	10	.62		
60	5.3	.68		

TABLE 4.- SUMMARY OF ENERGY-INTEGRATED DEUTERON CROSS SECTIONS

$\theta$ , deg	d $\sigma$ /d $\Omega$ , mb/sr, for -						W
	Be	C	Al	Fe	Cu	Ge	
10	17.5 ± 1.40	18.3 ± 1.47	27.9 ± 2.23	38.9 ± 3.11	43.3 ± 3.47	38.5 ± 3.08	61.9 ± 4.95
20	6.0 ± .48	7.6 ± .61	14.4 ± 1.15	21.3 ± 1.71	24.4 ± 1.95	21.9 ± 1.75	36.9 ± 2.95
30	3.1 ± .25	4.5 ± .36	8.7 ± .69	12.0 ± .96	14.7 ± 1.18	14.8 ± 1.19	27.3 ± 2.18
40		3.4 ± .27	6.7 ± .54	9.9 ± .79	11.9 ± .95	10.7 ± .85	21.2 ± 1.69
50	1.7 ± .14	2.3 ± .18	4.7 ± .37	7.0 ± .56	7.9 ± .63		22.1 ± 1.76
60	.7 ± .05	1.3 ± .10	2.6 ± .21	3.7 ± .30			13.7 ± 1.09
							20.5 ± 1.64
							.9.9 ± .79
							10.8 ± .86

TABLE 5.- CONSTANTS OF EQUATION  $d\sigma/d\Omega = \alpha A^\beta$  FOR DEUTERONS

$\theta$ , deg	Present data		$\beta$ from reference 11 (a)
	$\alpha$	$\beta$	
6.5			0.34
9.5			.40
10	6.6	0.43	
13.5			.46
16.0			.52
20	1.8	.59	
30	.78	.69	
40	.74	.64	
50	.39	.72	
60	.16	.80	

<sup>a</sup>Data taken from figure 6 of reference 11 for (p,d $\pi$ ) reaction.

TABLE 6.- ENERGY-INTEGRATED CROSS SECTIONS FOR THE  
QUASI-ELASTIC SCATTERING OF DEUTERONS

Target element	Energy-integrated cross section, mb/sr, at angle of scatter of -	
	$10^{\circ}$	$9.5^{\circ}$ (a)
Be	$2.9 \pm 0.5$	
C	$2.6 \pm .4$	$2.6 \pm 0.3$
Al	$3.7 \pm .6$	$3.7 \pm .5$
Fe	$4.5 \pm .8$	
Ge	$3.4 \pm .6$	
Cu	$3.8 \pm .6$	$5.2 \pm .7$
Pb	$7.0 \pm 1.2$	$6.9 \pm .9$
W	$8.2 \pm 1.4$	

<sup>a</sup>Data from reference 11 for  $p<2N> \rightarrow Nd$  reaction.

TABLE 7.- SUMMARY OF AVAILABLE DATA ON SELECTED ELEMENTS FOR INCIDENT PROTON ENERGIES FROM 160 MeV TO 660 MeV

Element	Energy, MeV (a)	Energy-integrated cross section, mb/sr, at angle of scatter of -								
		10°	18°	20°	24°	26°	30°	40°	45°	50°
Be	160						70.0 ± 2.0			
	450	365.6 ± 25.5					53.4 ± 7.2			
	558	376.0 ± 19.0	195.0 ± 10.0	122.4 ± 8.5	125.0 ± 6.0		64.7 ± 4.5	20.0 ± 1.7	36.6 ± 2.5	3.4 ± 0.2
	660						89.0 ± 4.0	54.0 ± 3.0		19.9 ± 1.3
C	160						75.0 ± 3.0			
	300					70.0 ± 4.0		52.3 ± 4.0		
	450	422.5 ± 29.5		136.5 ± 9.5			59.4 ± 7.4		22.4 ± 2.2	
	558	492.0 ± 15.0	230.0 ± 11.0		158.0 ± 8.0		80.4 ± 5.6	57.5 ± 4.0		4.7 ± 0.4
Al	160						114.0 ± 6.0	74.0 ± 4.0		31.9 ± 2.2
	300						124.0 ± 4.0			
	450					130.1 ± 5.0	94.2 ± 13.5		47.9 ± 3.3	
	558	455.4 ± 31.8		236.0 ± 16.5			146.3 ± 10.2	108.1 ± 7.5		
Fe	558	713.7 ± 49.9		347.2 ± 24.3				80.0 ± 3.0		43.0 ± 1.5
	300									
	558	845.5 ± 59.1		381.9 ± 26.7			188.5 ± 7.0	89.0 ± 4.0		
	660	1052.0 ± 53.0	556.0 ± 28.0		400.0 ± 20.0			36.6 ± 3.6		8.7 ± 0.6
Pb	300						204.6 ± 14.3	181.4 ± 12.7	133.7 ± 9.3	89.1 ± 6.2
	558	1130.0 ± 79.1		608.0 ± 42.5						
	660						447.6 ± 31.3	340.1 ± 23.8	242.7 ± 16.9	191.7 ± 13.4

<sup>a</sup>Data at various incident proton energies were obtained from the literature as follows:

- 160 MeV . . . . . Reference 2
- 300 MeV . . . . . Reference 6
- 450 MeV . . . . . Reference 5
- 558 MeV . . . . . Present data
- 660 MeV . . . . . Reference 7

TABLE 8.- RATIO OF DEUTERON TO PROTON ENERGY-INTEGRATED CROSS SECTIONS

Angle of scatter, deg	Ratio of deuteron to proton energy-integrated cross sections for -							
	Be	C	Al	Fe	Cu	Ge	Pb	W
10	0.048 ± 0.004	0.043 ± 0.004	0.061 ± 0.005	0.054 ± 0.005	0.051 ± 0.004	0.048 ± 0.004	0.054 ± 0.005	0.056 ± 0.005
20	.049 ± .004	.056 ± .005	.061 ± .005	.061 ± .005	.064 ± .005	.062 ± .005	.060 ± .005	.064 ± .005
30	.048 ± .004	.056 ± .005	.059 ± .005	.058 ± .005	.061 ± .005	.064 ± .005	.061 ± .005	.072 ± .006
40		.059 ± .005	.062 ± .005	.054 ± .005	.058 ± .005	.057 ± .005	.062 ± .005	.060 ± .005
50	.048 ± .004	.048 ± .004	.054 ± .005	.052 ± .004	.052 ± .004		.056 ± .005	.076 ± .007
60	.035 ± .003	.042 ± .003	.046 ± .004	.042 ± .003			.051 ± .004	.058 ± .005

TABLE 9.- PARAMETERS n AND b FROM POWER-LAW CURVE  $E^{-n}$  AND EXPONENTIAL CURVE  $e^{-E/b}$   
FITTED BY METHOD OF LEAST SQUARES TO CONTINUUM PART OF CROSS-SECTION DATA

(a) Proton cross-section data

$\theta$ , deg	Be		C		Al		Fe		Cu		Ge		W		Pb	
	n	b, MeV	n	b, MeV	n	b, MeV	n	b, MeV								
20	.26	489	.21	483	.40	265	.48	233	.45	229	.51	202	.81	188	.63	164
30	.45	267	.47	264	.58	208	.67	179	.73	166	.64	188	.83	156	a .73	141
40										a 198	a .61	173	.70	147	.73	141
50	.37	254	.33	272	.48	215	.53	197	.54	186	.56	150	.60	136	.87	a 128
60	.63	133	.54	153	.64	134	.52	150	.51	158			.69	119	.70	123

(b) Deuteron cross-section data

$\theta$ , deg	Be		C		Al		Fe		Cu		Ge		W		Pb	
	n	b, MeV	n	b, MeV	n	b, MeV										
20	1.1	169	1.0	a 187	1.2	159	1.3	a 142	1.3	a 144	1.4	a 140	1.60	120	1.6	123
30	1.4	138	1.3	138	1.7	115	1.8	a 109	1.7	115	1.8	a 104	2.1	a 93	2.1	a 91
40				a 104	2.1	a 86	2.1	a 88	2.2	a 86	2.2	a 88	2.4	a 79	2.4	a 78
50	1.9	a 91	2.2	80	2.3	a 75	2.7	a 69	2.7	a 69	2.7	a 56	2.6	a 65	a 1.5	134
60	3.0	a 52	2.8	a 53	2.8	a 56	2.9	a 56	3.0	a 56	3.0		3.1	a 54	3.0	a 55

<sup>a</sup>The curve associated with this parameter gives a superior fit to the data. Entries not footnoted give equally good fits.

TABLE 10.- DOUBLE DIFFERENTIAL CROSS SECTIONS FOR PRODUCTION OF  
SECONDARY PROTONS FROM BERYLLIUM TARGET, 2.35 g/cm<sup>2</sup> THICK

[Incident proton energy, 558 MeV]

(a) Angle of scatter of 10°

Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV
47.9	.000	93.1	.023	279.5	.021
48.5	.000	94.9	.024	290.2	.020
49.2	.000	96.7	.024	301.6	.018
49.8	.032	98.6	.024	313.8	.018
50.5	.032	100.4	.024	326.9	.017
51.2	.021	102.2	.023	340.9	.016
51.9	.022	104.1	.023	356.1	.014
52.6	.023	106.0	.023	372.4	.014
53.3	.023	108.0	.023	390.1	.014
54.0	.023	110.1	.023	409.3	.014
54.7	.023	111.9	.023	430.3	.014
55.4	.023	113.8	.023	453.3	.014
56.1	.023	115.7	.023	478.5	.014
56.8	.023	116.6	.023	506.5	.014
57.5	.023	118.5	.023	537.5	.014
58.2	.023	120.0	.023	572.2	.014
58.9	.023	121.9	.023	611.3	.014
59.6	.023	123.8	.023	655.7	.014
60.3	.023	126.7	.023	700.0	.014
61.0	.023	129.6	.023	743.0	.014
61.7	.023	132.5	.023	786.0	.014
62.4	.023	135.4	.023	830.0	.014
63.1	.023	138.3	.023	873.0	.014
63.8	.023	141.2	.023	916.0	.014
64.5	.023	144.1	.023	959.0	.014
65.2	.023	147.0	.023	1002.0	.014
65.9	.023	150.0	.023	1045.0	.014
66.6	.023	153.0	.023	1088.0	.014
67.3	.023	156.0	.023	1131.0	.014
68.0	.023	159.0	.023	1174.0	.014
68.7	.023	162.0	.023	1217.0	.014
69.4	.023	165.0	.023	1260.0	.014
70.1	.023	168.0	.023	1303.0	.014
70.8	.023	171.0	.023	1346.0	.014
71.5	.023	174.0	.023	1390.0	.014
72.2	.023	177.0	.023	1433.0	.014
72.9	.023	180.0	.023	1476.0	.014
73.6	.023	183.0	.023	1520.0	.014
74.3	.023	186.0	.023	1563.0	.014
75.0	.023	190.0	.023	1606.0	.014
75.7	.023	194.0	.023	1650.0	.014
76.4	.023	198.0	.023	1693.0	.014
77.1	.023	202.0	.023	1736.0	.014
77.8	.023	206.0	.023	1780.0	.014
78.5	.023	210.0	.023	1823.0	.014
79.2	.023	214.0	.023	1866.0	.014
79.9	.023	218.0	.023	1910.0	.014
80.6	.023	222.0	.023	1953.0	.014
81.3	.023	226.0	.023	1996.0	.014
82.0	.023	230.0	.023	2040.0	.014
82.7	.023	234.0	.023	2083.0	.014
83.4	.023	238.0	.023	2126.0	.014
84.1	.023	242.0	.023	2170.0	.014
84.8	.023	246.0	.023	2213.0	.014
85.5	.023	250.0	.023	2256.0	.014
86.2	.023	254.0	.023	2300.0	.014
86.9	.023	258.0	.023	2343.0	.014
87.6	.023	262.0	.023	2386.0	.014
88.3	.023	266.0	.023	2430.0	.014
89.0	.023	270.0	.023	2473.0	.014
89.7	.023	274.0	.023	2516.0	.014
90.4	.023	278.0	.023	2560.0	.014
91.1	.023	282.0	.023	2603.0	.014
91.8	.023	286.0	.023	2646.0	.014
92.5	.023	290.0	.023	2689.0	.014
93.2	.023	294.0	.023	2732.0	.014
93.9	.023	298.0	.023	2775.0	.014
94.6	.023	302.0	.023	2818.0	.014
95.3	.023	306.0	.023	2861.0	.014
96.0	.023	310.0	.023	2904.0	.014
96.7	.023	314.0	.023	2947.0	.014
97.4	.023	318.0	.023	2990.0	.014
98.1	.023	322.0	.023	3033.0	.014
98.8	.023	326.0	.023	3076.0	.014
99.5	.023	330.0	.023	3120.0	.014
100.2	.023	334.0	.023	3163.0	.014
100.9	.023	338.0	.023	3206.0	.014
101.6	.023	342.0	.023	3250.0	.014
102.3	.023	346.0	.023	3293.0	.014
103.0	.023	350.0	.023	3336.0	.014
103.7	.023	354.0	.023	3379.0	.014
104.4	.023	358.0	.023	3422.0	.014
105.1	.023	362.0	.023	3465.0	.014
105.8	.023	366.0	.023	3508.0	.014
106.5	.023	370.0	.023	3551.0	.014
107.2	.023	374.0	.023	3594.0	.014
107.9	.023	378.0	.023	3637.0	.014
108.6	.023	382.0	.023	3680.0	.014
109.3	.023	386.0	.023	3723.0	.014
110.0	.023	390.0	.023	3766.0	.014
110.7	.023	394.0	.023	3810.0	.014
111.4	.023	398.0	.023	3853.0	.014
112.1	.023	402.0	.023	3896.0	.014
112.8	.023	406.0	.023	3940.0	.014
113.5	.023	410.0	.023	3983.0	.014
114.2	.023	414.0	.023	4026.0	.014
114.9	.023	418.0	.023	4070.0	.014
115.6	.023	422.0	.023	4113.0	.014
116.3	.023	426.0	.023	4156.0	.014
117.0	.023	430.0	.023	4200.0	.014
117.7	.023	434.0	.023	4243.0	.014
118.4	.023	438.0	.023	4286.0	.014
119.1	.023	442.0	.023	4330.0	.014
119.8	.023	446.0	.023	4373.0	.014
120.5	.023	450.0	.023	4416.0	.014
121.2	.023	454.0	.023	4460.0	.014
121.9	.023	458.0	.023	4503.0	.014
122.6	.023	462.0	.023	4546.0	.014
123.3	.023	466.0	.023	4590.0	.014
124.0	.023	470.0	.023	4633.0	.014
124.7	.023	474.0	.023	4676.0	.014
125.4	.023	478.0	.023	4720.0	.014
126.1	.023	482.0	.023	4763.0	.014
126.8	.023	486.0	.023	4806.0	.014
127.5	.023	490.0	.023	4850.0	.014
128.2	.023	494.0	.023	4893.0	.014
128.9	.023	498.0	.023	4936.0	.014
129.6	.023	502.0	.023	4980.0	.014
130.3	.023	506.0	.023	5023.0	.014
131.0	.023	510.0	.023	5066.0	.014
131.7	.023	514.0	.023	5110.0	.014
132.4	.023	518.0	.023	5153.0	.014
133.1	.023	522.0	.023	5196.0	.014
133.8	.023	526.0	.023	5240.0	.014
134.5	.023	530.0	.023	5283.0	.014
135.2	.023	534.0	.023	5326.0	.014
135.9	.023	538.0	.023	5370.0	.014
136.6	.023	542.0	.023	5413.0	.014
137.3	.023	546.0	.023	5456.0	.014
138.0	.023	550.0	.023	5500.0	.014
138.7	.023	554.0	.023	5543.0	.014
139.4	.023	558.0	.023	5586.0	.014
140.1	.023	562.0	.023	5630.0	.014
140.8	.023	566.0	.023	5673.0	.014
141.5	.023	570.0	.023	5716.0	.014
142.2	.023	574.0	.023	5760.0	.014
142.9	.023	578.0	.023	5803.0	.014
143.6	.023	582.0	.023	5846.0	.014
144.3	.023	586.0	.023	5890.0	.014
145.0	.023	590.0	.023	5933.0	.014
145.7	.023	594.0	.023	5976.0	.014
146.4	.023	598.0	.023	6020.0	.014
147.1	.023	602.0	.023	6063.0	.014
147.8	.023	606.0	.023	6106.0	.014
148.5	.023	610.0	.023	6150.0	.014
149.2	.023	614.0	.023	6193.0	.014
149.9	.023	618.0	.023	6236.0	.014
150.6	.023	622.0	.023	6280.0	.014
151.3	.023	626.0	.023	6323.0	.014
152.0	.023	630.0	.023	6366.0	.014
152.7	.023	634.0	.023	6410.0	.014
153.4	.023	638.0	.023	6453.0	.014
154.1	.023	642.0	.023	6496.0	.014
154.8	.023	646.0	.023	6540.0	.014
155.5	.023	650.0	.023	6583.0	.014
156.2	.023	654.0	.023	6626.0	.014
156.9	.023	658.0	.023	6670.0	.014
157.6	.023	662.0	.023	6713.0	.014
158.3	.023	666.0	.023	6756.0	.014
159.0	.023	670.0	.023	6800.0	.014
159.7	.023	674.0	.023	6843.0	.014
160.4	.023	678.0	.023	6886.0	.014
161.1	.023	682.0	.023	6930.0	.014
161.8	.023	686.0	.023	6973.0	.014
162.5	.023	690.0	.023	7016.0	.014
163.2	.023	694.0	.023	7060.0	.014
163.9	.023	698.0	.023	7103.0	.014
164.6	.023	702.0	.023	7146.0	.014
165.3	.023	706.0	.023	7189.0	.014
166.0	.023	710.0	.023	7232.0	.014
166.7	.023	714.0	.023	7275.0	.014
167.4	.023	718.0	.023	7318.0	.014
168.1	.023	722.0	.023	7361.0	.014
168.8	.023	726.0	.023	7404.0	.014
169.5	.023	730.0	.023	7447.0	.014
170.2	.023	734.0	.023	7490.0	.014
170.9	.023	738.0	.023	7533.0	.014
171.6	.023	742.0	.023	7576.0	.014
172.3	.023	746.0	.023	7620.0	.014
173.0	.023	750.0	.023	7663.0	.014
173.7	.023	754.0	.023	7706.0	.014
174.4	.023	758.0	.023	7750.0	.014
175.1	.023	762.0	.023	7793.0	.014
175.8	.023	766.0	.023	7836.0	.014
176.5	.023	770.0	.023	7880.0	.014
177.2	.023				

TABLE 10.- Continued

(b) Angle of scatter of 20°

Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV
60.7 ± .8	.241 ± .021	132.9 ± 3.0	.016 ± .015	650.5 ± 46.6	.011 ± .001
61.6 ± .9	.240 ± .021	135.5 ± 3.2	.016 ± .016	700.4 ± 53.6	.006 ± .000
62.5 ± .9	.232 ± .020	138.1 ± 3.2	.016 ± .016		
63.4 ± .9	.194 ± .017	142.1 ± 3.2	.017 ± .016		
64.3 ± .9	.156 ± .016	145.5 ± 3.2	.016 ± .016		
65.2 ± .9	.152 ± .016	149.1 ± 3.2	.016 ± .016		
66.1 ± .9	.156 ± .016	152.7 ± 3.2	.016 ± .016		
67.0 ± .9	.160 ± .018	156.1 ± 3.2	.016 ± .016		
67.9 ± .9	.165 ± .018	160.7 ± 3.2	.016 ± .016		
68.8 ± .9	.169 ± .020	165.1 ± 3.2	.016 ± .016		
69.7 ± .9	.174 ± .023	169.7 ± 3.2	.016 ± .016		
70.6 ± .9	.178 ± .020	174.1 ± 3.2	.016 ± .016		
71.5 ± .9	.184 ± .020	178.7 ± 3.2	.016 ± .016		
72.4 ± .9	.189 ± .021	184.1 ± 3.2	.016 ± .016		
73.3 ± .9	.194 ± .021	189.7 ± 3.2	.016 ± .016		
74.2 ± .9	.204 ± .020	194.1 ± 3.2	.016 ± .016		
75.1 ± .9	.213 ± .018	198.7 ± 3.2	.016 ± .016		
76.0 ± .9	.189 ± .016	203.1 ± 3.2	.016 ± .016		
76.9 ± .9	.204 ± .020	207.7 ± 3.2	.016 ± .016		
77.8 ± .9	.223 ± .020	212.1 ± 3.2	.016 ± .016		
78.7 ± .9	.229 ± .020	216.7 ± 3.2	.016 ± .016		
79.6 ± .9	.239 ± .022	221.3 ± 3.2	.016 ± .016		
80.5 ± .9	.246 ± .022	226.7 ± 3.2	.016 ± .016		
81.4 ± .9	.241 ± .021	231.9 ± 3.2	.016 ± .016		
82.3 ± .9	.205 ± .021	236.4 ± 3.2	.016 ± .016		
83.2 ± .9	.222 ± .021	241.9 ± 3.2	.016 ± .016		
84.1 ± .9	.235 ± .021	246.4 ± 3.2	.016 ± .016		
85.0 ± .9	.242 ± .021	250.9 ± 3.2	.016 ± .016		
85.9 ± .9	.226 ± .020	255.5 ± 3.2	.016 ± .016		
86.8 ± .9	.222 ± .020	260.9 ± 3.2	.016 ± .016		
87.7 ± .9	.229 ± .020	265.9 ± 3.2	.016 ± .016		
88.6 ± .9	.234 ± .020	270.5 ± 3.2	.016 ± .016		
89.5 ± .9	.239 ± .020	275.1 ± 3.2	.016 ± .016		
90.4 ± .9	.244 ± .020	279.7 ± 3.2	.016 ± .016		
91.3 ± .9	.249 ± .020	284.3 ± 3.2	.016 ± .016		
92.2 ± .9	.254 ± .020	288.9 ± 3.2	.016 ± .016		
93.1 ± .9	.259 ± .020	293.5 ± 3.2	.016 ± .016		
94.0 ± .9	.264 ± .020	298.1 ± 3.2	.016 ± .016		
94.9 ± .9	.269 ± .020	302.7 ± 3.2	.016 ± .016		
95.8 ± .9	.274 ± .020	307.3 ± 3.2	.016 ± .016		
96.7 ± .9	.279 ± .020	311.9 ± 3.2	.016 ± .016		
97.6 ± .9	.284 ± .020	316.5 ± 3.2	.016 ± .016		
98.5 ± .9	.289 ± .020	321.1 ± 3.2	.016 ± .016		
99.4 ± .9	.294 ± .020	325.7 ± 3.2	.016 ± .016		
100.3 ± .9	.299 ± .020	330.3 ± 3.2	.016 ± .016		
101.2 ± .9	.304 ± .020	335.9 ± 3.2	.016 ± .016		
102.1 ± .9	.309 ± .020	340.5 ± 3.2	.016 ± .016		
103.0 ± .9	.314 ± .020	345.1 ± 3.2	.016 ± .016		
103.9 ± .9	.319 ± .020	350.7 ± 3.2	.016 ± .016		
104.8 ± .9	.324 ± .020	355.3 ± 3.2	.016 ± .016		
105.7 ± .9	.329 ± .020	360.9 ± 3.2	.016 ± .016		

TABLE 10.- Continued

(c) Angle of scatter of 30°

Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV
64.5	.9	192	.017	145.5	.3.5
65.4	1.0	199	.017	149.1	3.6
66.5	1.0	185	.016	152.9	3.8
67.5	1.0	189	.019	156.8	4.1
68.6	1.0	192	.017	160.8	4.3
69.7	1.0	200	.018	165.5	4.5
70.8	1.0	205	.018	169.1	4.7
71.9	1.0	197	.017	174.9	4.9
73.1	1.0	213	.019	178.9	5.1
74.3	1.0	208	.018	184.0	5.3
75.5	1.0	191	.017	189.2	5.5
76.8	1.0	207	.018	194.8	5.7
78.1	1.0	194	.017	200.6	5.9
79.4	1.0	192	.017	213.1	6.1
80.8	1.0	176	.015	219.8	6.3
82.2	1.0	186	.016	226.9	7.2
83.7	1.0	192	.017	234.4	7.6
85.2	1.0	198	.017	242.3	8.1
86.7	1.0	194	.015	250.6	8.6
88.3	1.0	192	.017	259.5	9.6
89.9	1.0	173	.015	268.9	10.7
91.6	1.0	174	.015	278.9	11.7
93.3	1.0	176	.015	289.5	12.5
95.0	1.0	173	.015	300.9	13.4
96.7	1.0	173	.015	313.0	14.5
98.4	1.0	174	.015	326.0	15.6
100.1	1.0	174	.015	339.9	16.8
101.8	1.0	174	.015	354.9	17.9
103.5	1.0	174	.015	371.1	18.2
105.2	1.0	174	.015	388.7	19.6
106.9	1.0	174	.015	407.7	21.7
108.6	1.0	173	.015	428.4	23.7
110.3	1.0	173	.014	451.1	26.0
112.0	1.0	173	.014	503.6	29.0
113.7	1.0	173	.014	534.2	32.2
115.4	1.0	173	.014	568.9	36.4
117.1	1.0	173	.014	606.9	40.6
118.8	1.0	173	.014	650.5	46.6
120.5	1.0	173	.014	700.4	53.6
122.2	1.0	173	.014	758.2	62.7
123.9	1.0	173	.014	826.0	73.8

TABLE 10.- Continued  
 (d) Angle of scatter of  $50^\circ$

Energy, MeV	Cross section, mb/sr-MeV						
.6	.000	94.4	.1.7	283.6	.10.5	264.5	.11.2
.6	.000	95.9	.1.8	294.5	.12.0	305.6	.12.9
.6	.000	97.8	.1.9	318.6	.13.8	320.4	.14.9
.6	.023	99.7	.2.0	312.0	.14.9	325.4	.15.9
.6	.022	101.6	.2.1	316.9	.15.9	329.4	.16.9
.6	.019	103.6	.2.2	321.1	.16.9	332.0	.17.9
.6	.019	105.7	.2.3	325.1	.17.9	336.4	.18.9
.6	.019	107.9	.2.4	329.2	.18.9	340.6	.19.9
.6	.021	110.1	.2.5	333.3	.19.9	345.8	.20.9
.6	.019	112.4	.2.6	337.4	.20.9	350.9	.21.9
.6	.017	114.8	.2.7	341.5	.21.9	356.8	.22.9
.6	.017	117.2	.2.8	345.7	.22.9	361.6	.23.9
.6	.017	120.7	.2.9	349.9	.23.9	365.8	.24.9
.6	.017	125.1	.3.0	354.2	.24.9	370.1	.25.9
.6	.017	129.7	.3.1	358.5	.25.9	374.4	.26.9
.6	.017	133.3	.3.2	362.8	.26.9	378.7	.27.4
.6	.017	137.9	.3.3	367.1	.27.4	383.0	.28.4
.6	.017	143.7	.3.4	371.4	.28.4	387.3	.29.4
.6	.017	150.2	.3.5	375.7	.29.4	391.6	.30.4
.6	.017	158.6	.3.6	380.0	.30.4	395.9	.31.4
.6	.017	167.1	.3.7	384.3	.31.4	400.2	.32.4
.6	.017	176.3	.3.8	388.7	.32.4	404.5	.33.4
.6	.017	186.2	.3.9	393.0	.33.4	408.8	.34.4
.6	.017	197.4	.4.0	397.3	.34.4	413.1	.35.4
.6	.017	209.1	.4.1	401.6	.35.4	417.4	.36.4
.6	.017	221.6	.4.2	405.9	.36.4	421.9	.37.4
.6	.017	230.7	.4.3	410.2	.37.4	426.3	.38.4
.6	.016	237.9	.4.4	414.5	.38.4	429.7	.39.4
.6	.016	246.6	.4.5	418.8	.39.4	434.0	.40.4
.6	.016	254.6	.4.6	423.1	.40.4	438.3	.41.4
.6	.016	263.7	.4.7	427.4	.41.4	442.6	.42.4
.6	.016	273.3	.4.8	431.7	.42.4	446.9	.43.4
.7	.000	48.4	.1.7	111.1	.1.7	111.1	.1.7
.7	.000	49.0	.1.8	111.1	.2.7	111.1	.2.7
.7	.000	50.6	.1.9	111.1	.3.7	111.1	.3.7
.7	.000	52.2	.2.0	111.1	.4.7	111.1	.4.7
.7	.000	53.8	.2.1	111.1	.5.7	111.1	.5.7
.7	.000	55.4	.2.2	111.1	.6.7	111.1	.6.7
.7	.000	57.0	.2.3	111.1	.7.7	111.1	.7.7
.7	.000	58.6	.2.4	111.1	.8.7	111.1	.8.7
.7	.000	60.2	.2.5	111.1	.9.7	111.1	.9.7
.7	.000	61.8	.2.6	111.1	.10.7	111.1	.10.7
.7	.000	63.4	.2.7	111.1	.11.7	111.1	.11.7
.7	.000	65.0	.2.8	111.1	.12.7	111.1	.12.7
.7	.000	66.6	.2.9	111.1	.13.7	111.1	.13.7
.7	.000	68.2	.3.0	111.1	.14.7	111.1	.14.7
.7	.000	70.8	.3.1	111.1	.15.7	111.1	.15.7
.7	.000	72.4	.3.2	111.1	.16.7	111.1	.16.7
.7	.000	74.0	.3.3	111.1	.17.7	111.1	.17.7
.7	.000	75.6	.3.4	111.1	.18.7	111.1	.18.7
.7	.000	77.2	.3.5	111.1	.19.7	111.1	.19.7
.7	.000	78.8	.3.6	111.1	.20.7	111.1	.20.7
.7	.000	80.4	.3.7	111.1	.21.7	111.1	.21.7
.7	.000	82.0	.3.8	111.1	.22.7	111.1	.22.7
.7	.000	83.6	.3.9	111.1	.23.7	111.1	.23.7
.7	.000	85.2	.4.0	111.1	.24.7	111.1	.24.7
.7	.000	86.8	.4.1	111.1	.25.7	111.1	.25.7
.7	.000	88.4	.4.2	111.1	.26.7	111.1	.26.7
.7	.000	90.0	.4.3	111.1	.27.7	111.1	.27.7
.7	.000	91.6	.4.4	111.1	.28.7	111.1	.28.7
.7	.000	93.2	.4.5	111.1	.29.7	111.1	.29.7
.7	.000	94.8	.4.6	111.1	.30.7	111.1	.30.7
.7	.000	96.4	.4.7	111.1	.31.7	111.1	.31.7
.7	.000	98.0	.4.8	111.1	.32.7	111.1	.32.7
.7	.000	99.6	.4.9	111.1	.33.7	111.1	.33.7
.7	.000	101.2	.5.0	111.1	.34.7	111.1	.34.7
.7	.000	102.8	.5.1	111.1	.35.7	111.1	.35.7
.7	.000	104.4	.5.2	111.1	.36.7	111.1	.36.7
.7	.000	106.0	.5.3	111.1	.37.7	111.1	.37.7
.7	.000	107.6	.5.4	111.1	.38.7	111.1	.38.7
.7	.000	109.2	.5.5	111.1	.39.7	111.1	.39.7
.7	.000	110.8	.5.6	111.1	.40.7	111.1	.40.7
.7	.000	112.4	.5.7	111.1	.41.7	111.1	.41.7
.7	.000	114.0	.5.8	111.1	.42.7	111.1	.42.7
.7	.000	115.6	.5.9	111.1	.43.7	111.1	.43.7
.7	.000	117.2	.6.0	111.1	.44.7	111.1	.44.7
.7	.000	118.8	.6.1	111.1	.45.7	111.1	.45.7
.7	.000	120.4	.6.2	111.1	.46.7	111.1	.46.7
.7	.000	122.0	.6.3	111.1	.47.7	111.1	.47.7
.7	.000	123.6	.6.4	111.1	.48.7	111.1	.48.7
.7	.000	125.2	.6.5	111.1	.49.7	111.1	.49.7
.7	.000	126.8	.6.6	111.1	.50.7	111.1	.50.7
.7	.000	128.4	.6.7	111.1	.51.7	111.1	.51.7
.7	.000	130.0	.6.8	111.1	.52.7	111.1	.52.7
.7	.000	131.6	.6.9	111.1	.53.7	111.1	.53.7
.7	.000	133.2	.7.0	111.1	.54.7	111.1	.54.7
.7	.000	134.8	.7.1	111.1	.55.7	111.1	.55.7
.7	.000	136.4	.7.2	111.1	.56.7	111.1	.56.7
.7	.000	138.0	.7.3	111.1	.57.7	111.1	.57.7
.7	.000	139.6	.7.4	111.1	.58.7	111.1	.58.7
.7	.000	141.2	.7.5	111.1	.59.7	111.1	.59.7
.7	.000	142.8	.7.6	111.1	.60.7	111.1	.60.7
.7	.000	144.4	.7.7	111.1	.61.7	111.1	.61.7
.7	.000	146.0	.7.8	111.1	.62.7	111.1	.62.7
.7	.000	147.6	.7.9	111.1	.63.7	111.1	.63.7
.7	.000	149.2	.8.0	111.1	.64.7	111.1	.64.7
.7	.000	150.8	.8.1	111.1	.65.7	111.1	.65.7
.7	.000	152.4	.8.2	111.1	.66.7	111.1	.66.7
.7	.000	154.0	.8.3	111.1	.67.7	111.1	.67.7
.7	.000	155.6	.8.4	111.1	.68.7	111.1	.68.7
.7	.000	157.2	.8.5	111.1	.69.7	111.1	.69.7
.7	.000	158.8	.8.6	111.1	.70.7	111.1	.70.7
.7	.000	160.4	.8.7	111.1	.71.7	111.1	.71.7
.7	.000	162.0	.8.8	111.1	.72.7	111.1	.72.7
.7	.000	163.6	.8.9	111.1	.73.7	111.1	.73.7
.7	.000	165.2	.9.0	111.1	.74.7	111.1	.74.7
.7	.000	166.8	.9.1	111.1	.75.7	111.1	.75.7
.7	.000	168.4	.9.2	111.1	.76.7	111.1	.76.7
.7	.000	170.0	.9.3	111.1	.77.7	111.1	.77.7
.7	.000	171.6	.9.4	111.1	.78.7	111.1	.78.7
.7	.000	173.2	.9.5	111.1	.79.7	111.1	.79.7
.7	.000	174.8	.9.6	111.1	.80.7	111.1	.80.7
.7	.000	176.4	.9.7	111.1	.81.7	111.1	.81.7
.7	.000	178.0	.9.8	111.1	.82.7	111.1	.82.7
.7	.000	179.6	.9.9	111.1	.83.7	111.1	.83.7
.7	.000	181.2	.10.0	111.1	.84.7	111.1	.84.7
.7	.000	182.8	.10.1	111.1	.85.7	111.1	.85.7
.7	.000	184.4	.10.2	111.1	.86.7	111.1	.86.7
.7	.000	186.0	.10.3	111.1	.87.7	111.1	.87.7
.7	.000	187.6	.10.4	111.1	.88.7	111.1	.88.7
.7	.000	189.2	.10.5	111.1	.89.7	111.1	.89.7
.7	.000	190.8	.10.6	111.1	.90.7	111.1	.90.7
.7	.000	192.4	.10.7	111.1	.91.7	111.1	.91.7
.7	.000	194.0	.10.8	111.1	.92.7	111.1	.92.7
.7	.000	195.6	.10.9	111.1	.93.7	111.1	.93.7
.7	.000	197.2	.11.0	111.1	.94.7	111.1	.94.7
.7	.000	198.8	.11.1	111.1	.95.7	111.1	.95.7
.7	.000	200.4	.11.2	111.1	.96.7	111.1	.96.7
.7	.000	202.0	.11.3	111.1	.97.7	111.1	.97.7
.7	.000	203.6	.11.4	111.1	.98.7	111.1	.98.7
.7	.000	205.2	.11.5	111.1	.99.7	111.1	.99.7
.7	.000	206.8	.11.6	111.1	.100.7	111.1	.100.7
.7	.000	208.4	.11.7	111.1	.101.7	111.1	.101.7
.7	.000	209.0	.11.8	111.1	.102.7	111.1	.102.7
.7	.000	210.6	.11.9	111.1	.103.7	111.1	.103.7
.7	.000	212.2	.12.0	111.1	.104.7	111.1	.104.7
.7	.000	213.8	.12.1	111.1	.105.7	111.1	.105.7
.7	.000	215.4	.12.2	111.1	.106.7	111.1	.106.7
.7	.000	217.0	.12.3	111.1	.107.7	111.1	.107.7
.7	.000	218.6	.12.4	111.1	.108.7	111.1	.108.7
.7	.000	220.2	.12.5	111.1	.109.7	111.1	.109.7
.7	.000	221.8	.12.6	111.1	.110.7	111.1	.110.7
.7	.000	223.4	.12.7	111.1	.111.7	111.1	.111.7
.7	.000	225.0	.12.8	111.1	.112.7	111.1	.112.7
.7	.000	226.6	.12.9	111.1	.113.7	111.1	.113.7
.7	.000	228.2	.13.0	111.1	.114.7	111.1	.114.7
.7	.000	229.8	.13.1	111.1	.115.7	111.1	.115.7

TABLE 10.- Concluded  
(e) Angle of scatter of  $60^\circ$

Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV
48.4	.000	1.7	.012	283.6	.012 ± 10.5
49.5	.000	1.8	.012	291.5	.010 ± 11.2
50.6	.000	1.9	.012	306.2	.008 ± 12.0
51.7	.000	2.0	.011	318.6	.006 ± 12.9
52.8	.000	2.1	.011	332.0	.003 ± 13.8
53.9	.000	2.2	.011	346.4	.002 ± 14.9
55.0	.000	2.3	.011	361.9	.001 ± 16.1
56.1	.000	2.4	.011	378.6	.001 ± 17.4
57.2	.000	2.5	.010	396.8	.001 ± 18.9
58.3	.000	2.6	.010	416.5	.000 ± 20.6
59.4	.000	2.7	.010	438.1	.000 ± 22.5
60.5	.000	2.8	.010	461.7	.000 ± 24.7
61.6	.000	2.9	.010	487.7	.000 ± 27.3
62.7	.000	3.0	.010	516.5	.000 ± 30.3
63.8	.000	3.1	.010	548.6	.000 ± 33.9
64.9	.000	3.2	.010	581.1	.000 ± 38.1
66.0	.000	3.3	.010	625.2	.000 ± 43.2
67.1	.000	3.4	.010	671.2	.000 ± 49.4
68.2	.000	3.5	.010	715.2	.000 ± 55.3
69.3	.000	3.6	.010	759.1	.000 ± 61.4
70.4	.000	3.7	.010	803.0	.000 ± 67.5
71.5	.000	3.8	.010	847.0	.000 ± 73.6
72.6	.000	3.9	.010	891.0	.000 ± 79.7
73.7	.000	4.0	.010	935.0	.000 ± 85.8
74.8	.000	4.1	.010	979.0	.000 ± 91.9
75.9	.000	4.2	.010	1023.0	.000 ± 97.3
77.0	.000	4.3	.010	1067.0	.000 ± 103.3
78.1	.000	4.4	.010	1112.0	.000 ± 108.3
79.2	.000	4.5	.010	1157.0	.000 ± 113.3
80.3	.000	4.6	.010	1202.0	.000 ± 118.3
81.4	.000	4.7	.010	1247.0	.000 ± 123.3
82.5	.000	4.8	.010	1292.0	.000 ± 128.3
83.6	.000	4.9	.010	1337.0	.000 ± 133.3
84.7	.000	5.0	.010	1382.0	.000 ± 138.3
85.8	.000	5.1	.010	1427.0	.000 ± 143.3
86.9	.000	5.2	.010	1472.0	.000 ± 148.3
88.0	.000	5.3	.010	1517.0	.000 ± 153.3
89.1	.000	5.4	.010	1562.0	.000 ± 158.3
90.2	.000	5.5	.010	1607.0	.000 ± 163.3
91.3	.000	5.6	.010	1652.0	.000 ± 168.3
92.4	.000	5.7	.010	1697.0	.000 ± 173.3
93.5	.000	5.8	.010	1742.0	.000 ± 178.3
94.6	.000	5.9	.010	1786.0	.000 ± 183.3
95.7	.000	6.0	.010	1831.0	.000 ± 188.3
96.8	.000	6.1	.010	1876.0	.000 ± 193.3
97.9	.000	6.2	.010	1921.0	.000 ± 198.3
99.0	.000	6.3	.010	1966.0	.000 ± 203.3
100.1	.000	6.4	.010	2011.0	.000 ± 208.3
101.2	.000	6.5	.010	2056.0	.000 ± 213.3
102.3	.000	6.6	.010	2101.0	.000 ± 218.3
103.4	.000	6.7	.010	2146.0	.000 ± 223.3
104.5	.000	6.8	.010	2191.0	.000 ± 228.3
105.6	.000	6.9	.010	2236.0	.000 ± 233.3
106.7	.000	7.0	.010	2281.0	.000 ± 238.3
107.8	.000	7.1	.010	2326.0	.000 ± 243.3
108.9	.000	7.2	.010	2371.0	.000 ± 248.3
109.10	.000	7.3	.010	2416.0	.000 ± 253.3
110.11	.000	7.4	.010	2461.0	.000 ± 258.3
111.12	.000	7.5	.010	2506.0	.000 ± 263.3
112.13	.000	7.6	.010	2551.0	.000 ± 268.3
113.14	.000	7.7	.010	2596.0	.000 ± 273.3
114.15	.000	7.8	.010	2641.0	.000 ± 278.3
115.16	.000	7.9	.010	2686.0	.000 ± 283.3
116.17	.000	8.0	.010	2731.0	.000 ± 288.3
117.18	.000	8.1	.010	2776.0	.000 ± 293.3
118.19	.000	8.2	.010	2821.0	.000 ± 298.3
119.20	.000	8.3	.010	2866.0	.000 ± 303.3
120.21	.000	8.4	.010	2911.0	.000 ± 308.3
121.22	.000	8.5	.010	2956.0	.000 ± 313.3
122.23	.000	8.6	.010	3001.0	.000 ± 318.3
123.24	.000	8.7	.010	3046.0	.000 ± 323.3
124.25	.000	8.8	.010	3091.0	.000 ± 328.3
125.26	.000	8.9	.010	3136.0	.000 ± 333.3
126.27	.000	9.0	.010	3181.0	.000 ± 338.3
127.28	.000	9.1	.010	3226.0	.000 ± 343.3
128.29	.000	9.2	.010	3271.0	.000 ± 348.3
129.30	.000	9.3	.010	3316.0	.000 ± 353.3
130.31	.000	9.4	.010	3361.0	.000 ± 358.3
131.32	.000	9.5	.010	3406.0	.000 ± 363.3
132.33	.000	9.6	.010	3451.0	.000 ± 368.3
133.34	.000	9.7	.010	3496.0	.000 ± 373.3
134.35	.000	9.8	.010	3541.0	.000 ± 378.3
135.36	.000	9.9	.010	3586.0	.000 ± 383.3
136.37	.000	10.0	.010	3631.0	.000 ± 388.3
137.38	.000	10.1	.010	3676.0	.000 ± 393.3
138.39	.000	10.2	.010	3721.0	.000 ± 398.3
139.40	.000	10.3	.010	3766.0	.000 ± 403.3
140.41	.000	10.4	.010	3811.0	.000 ± 408.3
141.42	.000	10.5	.010	3856.0	.000 ± 413.3
142.43	.000	10.6	.010	3901.0	.000 ± 418.3
143.44	.000	10.7	.010	3946.0	.000 ± 423.3
144.45	.000	10.8	.010	3991.0	.000 ± 428.3
145.46	.000	10.9	.010	4036.0	.000 ± 433.3
146.47	.000	11.0	.010	4081.0	.000 ± 438.3
147.48	.000	11.1	.010	4126.0	.000 ± 443.3
148.49	.000	11.2	.010	4171.0	.000 ± 448.3
149.50	.000	11.3	.010	4216.0	.000 ± 453.3
150.51	.000	11.4	.010	4261.0	.000 ± 458.3
151.52	.000	11.5	.010	4306.0	.000 ± 463.3
152.53	.000	11.6	.010	4351.0	.000 ± 468.3
153.54	.000	11.7	.010	4396.0	.000 ± 473.3
154.55	.000	11.8	.010	4441.0	.000 ± 478.3
155.56	.000	11.9	.010	4486.0	.000 ± 483.3
156.57	.000	12.0	.010	4531.0	.000 ± 488.3
157.58	.000	12.1	.010	4576.0	.000 ± 493.3
158.59	.000	12.2	.010	4621.0	.000 ± 498.3
159.60	.000	12.3	.010	4666.0	.000 ± 503.3
160.61	.000	12.4	.010	4711.0	.000 ± 508.3
161.62	.000	12.5	.010	4756.0	.000 ± 513.3
162.63	.000	12.6	.010	4801.0	.000 ± 518.3
163.64	.000	12.7	.010	4846.0	.000 ± 523.3
164.65	.000	12.8	.010	4891.0	.000 ± 528.3
165.66	.000	12.9	.010	4936.0	.000 ± 533.3
166.67	.000	13.0	.010	4981.0	.000 ± 538.3
167.68	.000	13.1	.010	5026.0	.000 ± 543.3
168.69	.000	13.2	.010	5071.0	.000 ± 548.3
169.70	.000	13.3	.010	5116.0	.000 ± 553.3
170.71	.000	13.4	.010	5161.0	.000 ± 558.3
171.72	.000	13.5	.010	5206.0	.000 ± 563.3
172.73	.000	13.6	.010	5251.0	.000 ± 568.3
173.74	.000	13.7	.010	5296.0	.000 ± 573.3
174.75	.000	13.8	.010	5341.0	.000 ± 578.3
175.76	.000	13.9	.010	5386.0	.000 ± 583.3
176.77	.000	14.0	.010	5431.0	.000 ± 588.3
177.78	.000	14.1	.010	5476.0	.000 ± 593.3
178.79	.000	14.2	.010	5521.0	.000 ± 598.3
179.80	.000	14.3	.010	5566.0	.000 ± 603.3
180.81	.000	14.4	.010	5611.0	.000 ± 608.3
181.82	.000	14.5	.010	5656.0	.000 ± 613.3
182.83	.000	14.6	.010	5701.0	.000 ± 618.3
183.84	.000	14.7	.010	5746.0	.000 ± 623.3
184.85	.000	14.8	.010	5791.0	.000 ± 628.3
185.86	.000	14.9	.010	5836.0	.000 ± 633.3
186.87	.000	15.0	.010	5881.0	.000 ± 638.3
187.88	.000	15.1	.010	5926.0	.000 ± 643.3
188.89	.000	15.2	.010	5971.0	.000 ± 648.3
189.90	.000	15.3	.010	6016.0	.000 ± 653.3
190.91	.000	15.4	.010	6061.0	.000 ± 658.3
191.92	.000	15.5	.010	6106.0	.000 ± 663.3
192.93	.000	15.6	.010	6151.0	.000 ± 668.3
193.94	.000	15.7	.010	6196.0	.000 ± 673.3
194.95	.000	15.8	.010	6241.0	.000 ± 678.3
195.96	.000	15.9	.010	6286.0	.000 ± 683.3
196.97	.000	16.0	.010	6331.0	.000 ± 688.3
197.98	.000	16.1	.010	6376.0	.000 ± 693.3
198.99	.000	16.2	.010	6421.0	.000 ± 698.3
199.100	.000	16.3	.010	6466.0	.000 ± 703.3
200.101	.000	16.4	.010	6511.0	.000 ± 708.3
201.102	.000	16.5	.010	6556.0	.000 ± 713.3
202.103	.000	16.6	.010	6601.0	.000 ± 718.3
203.104	.000	16.7	.010	6646.0	.000 ± 723.3
204.105	.000	16.8	.010	6691.0	.000 ± 728.3
205.106	.000	16.9	.010	6736.0	.000 ± 733.3
206.107	.000	17.0	.010	6781.0	.000 ± 738.3
207.108	.000	17.1	.010	6826.0	.000 ± 743.3
208.109	.000	17.2	.010	6871.0	.000 ± 748.3
209.110	.000	17.3	.010	6916.0	.000 ± 753.3
210.111	.000	17.4	.010	6961.0	.000 ± 758.3
211.112	.000	17.5	.010	7006.0	.000 ± 763.3
212.113	.000	17.6	.010	7051.0	.000 ± 768.3
213.114	.000	17.7	.010	7096.0	.000 ± 773.3
214.115	.000	17.8	.010	7141.0	.000 ± 778.3
215.116	.000	17.9	.010	7186.0	.000 ± 783.3
216.117	.000	18.0	.010	7231.0	.000 ± 788.3
217.118	.000	18.1	.010	7276.0	.000 ± 793.3
218.119	.000	18.2	.010	7321.0	.000 ± 798.3
219.120	.000	18.3	.010	7366.0	.000 ± 803.3
220.121	.000	18.4	.010	7411.0	.000 ± 808.3
221.122	.000	18.5	.010	7456.0	.000 ± 813.3

TABLE 11.- DOUBLE DIFFERENTIAL CROSS SECTIONS FOR PRODUCTION OF  
SECONDARY PROTONS FROM CARBON TARGET, 0.95 g/cm<sup>2</sup> THICK

[Incident proton energy, 558 MeV]

(a) Angle of scatter of 10°

Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV
47.9	.6	93.1	.1	279.5	.3
48.6	.6	93.9	.1	290.2	.3
48.6	.6	96.7	.1	290.6	.3
48.6	.6	98.6	.1	291.6	.3
49.3	.023	98.6	.1	291.8	.3
49.3	.023	100.5	.1	292.6	.3
49.3	.023	102.5	.1	293.3	.3
49.3	.023	104.6	.1	294.1	.3
49.3	.023	106.9	.1	294.9	.3
49.3	.023	108.9	.1	295.7	.3
49.3	.023	111.2	.1	296.5	.3
49.3	.023	113.5	.1	297.3	.3
49.3	.023	115.9	.1	298.1	.3
49.3	.023	118.0	.1	298.9	.3
49.3	.023	121.0	.1	299.7	.3
49.3	.023	123.3	.1	300.5	.3
49.3	.023	126.7	.1	301.3	.3
49.3	.023	129.3	.1	302.1	.3
49.3	.023	132.0	.1	302.9	.3
49.3	.023	134.9	.1	303.7	.3
49.3	.023	137.0	.1	304.5	.3
49.3	.023	139.0	.1	305.3	.3
49.3	.023	142.4	.1	306.1	.3
49.3	.023	145.2	.1	306.9	.3
49.3	.023	148.0	.1	307.7	.3
49.3	.023	150.8	.1	308.5	.3
49.3	.023	153.6	.1	309.3	.3
49.3	.023	156.4	.1	310.1	.3
49.3	.023	159.2	.1	310.9	.3
49.3	.023	162.0	.1	311.7	.3
49.3	.023	164.9	.1	312.5	.3
49.3	.023	167.8	.1	313.3	.3
49.3	.023	170.8	.1	314.1	.3
49.3	.023	173.8	.1	314.9	.3
49.3	.023	176.8	.1	315.7	.3
49.3	.023	179.8	.1	316.5	.3
49.3	.023	182.8	.1	317.3	.3
49.3	.023	185.8	.1	318.1	.3
49.3	.023	188.8	.1	318.9	.3
49.3	.023	191.8	.1	319.7	.3
49.3	.023	194.8	.1	320.5	.3
49.3	.023	197.8	.1	321.3	.3
49.3	.023	200.8	.1	322.1	.3
49.3	.023	203.8	.1	322.9	.3
49.3	.023	206.8	.1	323.7	.3
49.3	.023	209.8	.1	324.5	.3
49.3	.023	212.8	.1	325.3	.3
49.3	.023	215.8	.1	326.1	.3
49.3	.023	218.8	.1	326.9	.3
49.3	.023	221.8	.1	327.7	.3
49.3	.023	224.8	.1	328.5	.3
49.3	.023	227.8	.1	329.3	.3
49.3	.023	230.8	.1	329.7	.3
49.3	.023	233.8	.1	330.5	.3
49.3	.023	236.8	.1	331.3	.3
49.3	.023	239.8	.1	332.1	.3
49.3	.023	242.8	.1	332.9	.3
49.3	.023	245.8	.1	333.7	.3
49.3	.023	248.8	.1	334.5	.3
49.3	.023	251.8	.1	335.3	.3
49.3	.023	254.8	.1	336.1	.3
49.3	.023	257.8	.1	336.9	.3
49.3	.023	260.8	.1	337.7	.3
49.3	.023	263.8	.1	338.5	.3
49.3	.023	266.8	.1	339.3	.3
49.3	.023	269.8	.1	339.7	.3
49.3	.023	272.8	.1	340.5	.3
49.3	.023	275.8	.1	341.3	.3
49.3	.023	278.8	.1	342.1	.3
49.3	.023	281.8	.1	342.9	.3
49.3	.023	284.8	.1	343.7	.3
49.3	.023	287.8	.1	344.5	.3
49.3	.023	290.8	.1	345.3	.3
49.3	.023	293.8	.1	346.1	.3
49.3	.023	296.8	.1	346.9	.3
49.3	.023	299.8	.1	347.7	.3
49.3	.023	302.8	.1	348.5	.3
49.3	.023	305.8	.1	349.3	.3
49.3	.023	308.8	.1	349.7	.3
49.3	.023	311.8	.1	350.5	.3
49.3	.023	314.8	.1	351.3	.3
49.3	.023	317.8	.1	352.1	.3
49.3	.023	320.8	.1	352.9	.3
49.3	.023	323.8	.1	353.7	.3
49.3	.023	326.8	.1	354.5	.3
49.3	.023	329.8	.1	355.3	.3
49.3	.023	332.8	.1	356.1	.3
49.3	.023	335.8	.1	356.9	.3
49.3	.023	338.8	.1	357.7	.3
49.3	.023	341.8	.1	358.5	.3
49.3	.023	344.8	.1	359.3	.3
49.3	.023	347.8	.1	360.1	.3
49.3	.023	350.8	.1	360.9	.3
49.3	.023	353.8	.1	361.7	.3
49.3	.023	356.8	.1	362.5	.3
49.3	.023	359.8	.1	363.3	.3
49.3	.023	362.8	.1	364.1	.3
49.3	.023	365.8	.1	364.9	.3
49.3	.023	368.8	.1	365.7	.3
49.3	.023	371.8	.1	366.5	.3
49.3	.023	374.8	.1	367.3	.3
49.3	.023	377.8	.1	368.1	.3
49.3	.023	380.8	.1	368.9	.3
49.3	.023	383.8	.1	369.7	.3
49.3	.023	386.8	.1	370.5	.3
49.3	.023	389.8	.1	371.3	.3
49.3	.023	392.8	.1	372.1	.3
49.3	.023	395.8	.1	372.9	.3
49.3	.023	398.8	.1	373.7	.3
49.3	.023	401.8	.1	374.5	.3
49.3	.023	404.8	.1	375.3	.3
49.3	.023	407.8	.1	376.1	.3
49.3	.023	410.8	.1	376.9	.3
49.3	.023	413.8	.1	377.7	.3
49.3	.023	416.8	.1	378.5	.3
49.3	.023	419.8	.1	379.3	.3
49.3	.023	422.8	.1	379.7	.3
49.3	.023	425.8	.1	380.5	.3
49.3	.023	428.8	.1	381.3	.3
49.3	.023	431.8	.1	382.1	.3
49.3	.023	434.8	.1	382.9	.3
49.3	.023	437.8	.1	383.7	.3
49.3	.023	440.8	.1	384.5	.3
49.3	.023	443.8	.1	385.3	.3
49.3	.023	446.8	.1	386.1	.3
49.3	.023	449.8	.1	386.9	.3
49.3	.023	452.8	.1	387.7	.3
49.3	.023	455.8	.1	388.5	.3
49.3	.023	458.8	.1	389.3	.3
49.3	.023	461.8	.1	389.7	.3
49.3	.023	464.8	.1	390.5	.3
49.3	.023	467.8	.1	391.3	.3
49.3	.023	470.8	.1	392.1	.3
49.3	.023	473.8	.1	392.9	.3
49.3	.023	476.8	.1	393.7	.3
49.3	.023	479.8	.1	394.5	.3
49.3	.023	482.8	.1	395.3	.3
49.3	.023	485.8	.1	396.1	.3
49.3	.023	488.8	.1	396.9	.3
49.3	.023	491.8	.1	397.7	.3
49.3	.023	494.8	.1	398.5	.3
49.3	.023	497.8	.1	399.3	.3
49.3	.023	500.8	.1	400.1	.3
49.3	.023	503.8	.1	400.9	.3
49.3	.023	506.8	.1	401.7	.3
49.3	.023	509.8	.1	402.5	.3
49.3	.023	512.8	.1	403.3	.3
49.3	.023	515.8	.1	404.1	.3
49.3	.023	518.8	.1	404.9	.3
49.3	.023	521.8	.1	405.7	.3
49.3	.023	524.8	.1	406.5	.3
49.3	.023	527.8	.1	407.3	.3
49.3	.023	530.8	.1	408.1	.3
49.3	.023	533.8	.1	408.9	.3
49.3	.023	536.8	.1	409.7	.3
49.3	.023	539.8	.1	410.5	.3
49.3	.023	542.8	.1	411.3	.3
49.3	.023	545.8	.1	412.1	.3
49.3	.023	548.8	.1	412.9	.3
49.3	.023	551.8	.1	413.7	.3
49.3	.023	554.8	.1	414.5	.3
49.3	.023	557.8	.1	415.3	.3
49.3	.023	560.8	.1	416.1	.3
49.3	.023	563.8	.1	416.9	.3
49.3	.023	566.8	.1	417.7	.3
49.3	.023	569.8	.1	418.5	.3
49.3	.023	572.8	.1	419.3	.3
49.3	.023	575.8	.1	420.1	.3
49.3	.023	578.8	.1	420.9	.3
49.3	.023	581.8	.1	421.7	.3
49.3	.023	584.8	.1	422.5	.3
49.3	.023	587.8	.1	423.3	.3
49.3	.023	590.8	.1	424.1	.3
49.3	.023	593.8	.1	424.9	.3
49.3	.023	596.8	.1	425.7	.3
49.3	.023	599.8	.1	426.5	.3
49.3	.023	602.8	.1	427.3	.3
49.3	.023	605.8	.1	428.1	.3
49.3	.023	608.8	.1	428.9	.3
49.3	.023	611.8	.1	429.7	.3
49.3	.023	614.8	.1	430.5	.3
49.3	.023	617.8	.1	431.3	.3
49.3	.023	620.8	.1	432.1	.3
49.3	.023	623.8	.1	432.9	.3
49.3	.023	626.8	.1	433.7	.3
49.3	.023	629.8	.1	434.5	.3
49.3	.023	632.8	.1	435.3	.3
49.3	.023	635.8	.1	436.1	.3
49.3	.023	638.8	.1	436.9	.3
49.3	.023	641.8	.1	437.7	.3
49.3	.023	644.8	.1	438.5	.3
49.3	.023	647.8	.1	439.3	.3
49.3	.023	650.8	.1	440.1	.3
49.3	.023	653.8	.1	440.9	.3
49.3	.023	656.8	.1	441.7	.3
49.3	.023	659.8	.1	442.5	.3
49.3	.023	662.8	.1	443.3	.3
49.3	.023	665.8	.1	444.1	.3
49.3	.023	668.8	.1	444.9	.3
49.3	.023	671.8	.1	445.7	.3
49.3	.023	674.8	.1	446.5	.3
49.3	.023	677.8	.1	447.3	.3
49.3	.023	680.8	.1	448.1	.3
49.3	.023	683.8	.1	448.9	.3

TABLE 11:- Continued

(b) Angle of scatter of  $20^\circ$

TABLE 11.- Continued

(c) Angle of scatter of 30°

Energy, MeV	Cross section mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV
60.7	.025	132.4	.204	650.5	.002
61.6	.285	135.5	.200	700.4	.002
65.6	.252	142.5	.197		.000
67.6	.268	145.7	.196		.000
68.6	.233	149.1	.196		.000
70.6	.224	152.1	.196		.000
73.6	.223	156.0	.196		.000
75.6	.228	160.0	.196		.000
76.6	.229	165.0	.196		.000
78.6	.229	174.0	.196		.000
80.6	.229	184.0	.196		.000
82.6	.229	194.0	.196		.000
83.6	.229	200.0	.196		.000
85.6	.229	213.0	.196		.000
86.6	.229	219.0	.196		.000
88.6	.229	226.0	.196		.000
89.6	.229	234.0	.196		.000
90.6	.229	250.0	.196		.000
92.6	.229	268.0	.196		.000
93.6	.229	278.0	.196		.000
94.6	.229	289.0	.196		.000
95.6	.229	300.0	.196		.000
96.6	.229	313.0	.196		.000
97.6	.229	326.0	.196		.000
98.6	.229	339.0	.196		.000
99.6	.229	354.0	.196		.000
100.6	.229	371.0	.196		.000
102.6	.229	388.0	.196		.000
104.6	.229	407.0	.196		.000
106.6	.229	428.0	.196		.000
109.6	.229	445.0	.196		.000
111.6	.229	476.0	.196		.000
113.6	.229	503.0	.196		.000
116.6	.229	534.0	.196		.000
118.6	.229	568.0	.196		.000
121.6	.229	606.0	.196		.000
123.6	.229	636.0	.196		.000
126.5	.229	660.0	.196		.000
129.5	.229	690.0	.196		.000

TABLE 11.- Continued  
(d) Angle of scatter of 40°

Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV
6.6	6.6	6.6	6.6	6.6	6.6
48.0	48.0	48.0	48.0	48.0	48.0
70.7	70.7	70.7	70.7	70.7	70.7
71.3	71.3	71.3	71.3	71.3	71.3
73.0	73.0	73.0	73.0	73.0	73.0
75.7	75.7	75.7	75.7	75.7	75.7
76.9	76.9	76.9	76.9	76.9	76.9
77.7	77.7	77.7	77.7	77.7	77.7
78.7	78.7	78.7	78.7	78.7	78.7
79.7	79.7	79.7	79.7	79.7	79.7
80.6	80.6	80.6	80.6	80.6	80.6
83.5	83.5	83.5	83.5	83.5	83.5
85.6	85.6	85.6	85.6	85.6	85.6
89.1	89.1	89.1	89.1	89.1	89.1
242	242	242	242	242	242
244	244	244	244	244	244
246	246	246	246	246	246
248	248	248	248	248	248
250	250	250	250	250	250
252	252	252	252	252	252
254	254	254	254	254	254
256	256	256	256	256	256
258	258	258	258	258	258
260	260	260	260	260	260
262	262	262	262	262	262
264	264	264	264	264	264
266	266	266	266	266	266
268	268	268	268	268	268
270	270	270	270	270	270
272	272	272	272	272	272
274	274	274	274	274	274
276	276	276	276	276	276
278	278	278	278	278	278
280	280	280	280	280	280
284	284	284	284	284	284
288	288	288	288	288	288
292	292	292	292	292	292
296	296	296	296	296	296
300	300	300	300	300	300
304	304	304	304	304	304
308	308	308	308	308	308
312	312	312	312	312	312
316	316	316	316	316	316
320	320	320	320	320	320
324	324	324	324	324	324
328	328	328	328	328	328
332	332	332	332	332	332
336	336	336	336	336	336
340	340	340	340	340	340
344	344	344	344	344	344
348	348	348	348	348	348
352	352	352	352	352	352
356	356	356	356	356	356
360	360	360	360	360	360
364	364	364	364	364	364
368	368	368	368	368	368
372	372	372	372	372	372
376	376	376	376	376	376
380	380	380	380	380	380
384	384	384	384	384	384
388	388	388	388	388	388
392	392	392	392	392	392
396	396	396	396	396	396
400	400	400	400	400	400
404	404	404	404	404	404
408	408	408	408	408	408
412	412	412	412	412	412
416	416	416	416	416	416
420	420	420	420	420	420
424	424	424	424	424	424
428	428	428	428	428	428
432	432	432	432	432	432
436	436	436	436	436	436
440	440	440	440	440	440
444	444	444	444	444	444
448	448	448	448	448	448
452	452	452	452	452	452
456	456	456	456	456	456
460	460	460	460	460	460
464	464	464	464	464	464
468	468	468	468	468	468
472	472	472	472	472	472
476	476	476	476	476	476
480	480	480	480	480	480
484	484	484	484	484	484
488	488	488	488	488	488
492	492	492	492	492	492
496	496	496	496	496	496
500	500	500	500	500	500
504	504	504	504	504	504
508	508	508	508	508	508
512	512	512	512	512	512
516	516	516	516	516	516
520	520	520	520	520	520
524	524	524	524	524	524
528	528	528	528	528	528
532	532	532	532	532	532
536	536	536	536	536	536
540	540	540	540	540	540
544	544	544	544	544	544
548	548	548	548	548	548
552	552	552	552	552	552
556	556	556	556	556	556
560	560	560	560	560	560
564	564	564	564	564	564
568	568	568	568	568	568
572	572	572	572	572	572
576	576	576	576	576	576
580	580	580	580	580	580
584	584	584	584	584	584
588	588	588	588	588	588
592	592	592	592	592	592
596	596	596	596	596	596
600	600	600	600	600	600
604	604	604	604	604	604
608	608	608	608	608	608
612	612	612	612	612	612
616	616	616	616	616	616
620	620	620	620	620	620
624	624	624	624	624	624
628	628	628	628	628	628
632	632	632	632	632	632
636	636	636	636	636	636
640	640	640	640	640	640
644	644	644	644	644	644
648	648	648	648	648	648
652	652	652	652	652	652
656	656	656	656	656	656
660	660	660	660	660	660
664	664	664	664	664	664
668	668	668	668	668	668
672	672	672	672	672	672
676	676	676	676	676	676
680	680	680	680	680	680
684	684	684	684	684	684
688	688	688	688	688	688
692	692	692	692	692	692
696	696	696	696	696	696
700	700	700	700	700	700

TABLE 11.- Continued

Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV
48.4	.6	48.0	.000	49.4	.000
49.4	.456	49.1	.036	50.4	.000
50.4	.366	50.3	.033	51.4	.000
51.4	.302	51.3	.026	52.4	.000
52.4	.319	52.3	.026	53.4	.000
53.4	.282	53.3	.026	54.4	.000
54.4	.270	54.3	.026	55.4	.000
55.4	.251	55.3	.026	56.4	.000
56.4	.266	56.3	.026	57.4	.000
57.4	.249	57.3	.026	58.4	.000
58.4	.257	58.3	.026	59.4	.000
59.4	.247	59.3	.026	60.4	.000
60.4	.257	60.3	.026	61.4	.000
61.4	.249	61.3	.026	62.4	.000
62.4	.257	62.3	.026	63.4	.000
63.4	.249	63.3	.026	64.4	.000
64.4	.257	64.3	.026	65.4	.000
65.4	.249	65.3	.026	66.4	.000
66.4	.257	66.3	.026	67.4	.000
67.4	.249	67.3	.026	68.4	.000
68.4	.257	68.3	.026	69.4	.000
69.4	.249	69.3	.026	70.4	.000
70.4	.257	70.3	.026	71.4	.000
71.4	.249	71.3	.026	72.4	.000
72.4	.257	72.3	.026	73.4	.000
73.4	.249	73.3	.026	74.4	.000
74.4	.257	74.3	.026	75.4	.000
75.4	.249	75.3	.026	76.4	.000
76.4	.257	76.3	.026	77.4	.000
77.4	.249	77.3	.026	78.4	.000
78.4	.257	78.3	.026	79.4	.000
79.4	.249	79.3	.026	80.4	.000
80.4	.257	80.3	.026	81.4	.000
81.4	.249	81.3	.026	82.4	.000
82.4	.257	82.3	.026	83.4	.000
83.4	.249	83.3	.026	84.4	.000
84.4	.257	84.3	.026	85.4	.000
85.4	.249	85.3	.026	86.4	.000
86.4	.257	86.3	.026	87.4	.000
87.4	.249	87.3	.026	88.4	.000
88.4	.257	88.3	.026	89.4	.000
89.4	.249	89.3	.026	90.4	.000
90.4	.257	90.3	.026	91.4	.000
91.4	.249	91.3	.026	92.4	.000
92.4	.257	92.3	.026	93.4	.000
93.4	.249	93.3	.026	94.4	.000
94.4	.257	94.3	.026	95.4	.000
95.4	.249	95.3	.026	96.4	.000
96.4	.257	96.3	.026	97.4	.000
97.4	.249	97.3	.026	98.4	.000
98.4	.257	98.3	.026	99.4	.000
99.4	.249	99.3	.026	100.4	.000
100.4	.257	100.3	.026	101.4	.000
101.4	.249	101.3	.026	102.4	.000
102.4	.257	102.3	.026	103.4	.000
103.4	.249	103.3	.026	104.4	.000
104.4	.257	104.3	.026	105.4	.000
105.4	.249	105.3	.026	106.4	.000
106.4	.257	106.3	.026	107.4	.000
107.4	.249	107.3	.026	108.4	.000
108.4	.257	108.3	.026	109.4	.000
109.4	.249	109.3	.026	110.4	.000
110.4	.257	110.3	.026	111.4	.000
111.4	.249	111.3	.026	112.4	.000
112.4	.257	112.3	.026	113.4	.000
113.4	.249	113.3	.026	114.4	.000
114.4	.257	114.3	.026	115.4	.000
115.4	.249	115.3	.026	116.4	.000
116.4	.257	116.3	.026	117.4	.000
117.4	.249	117.3	.026	118.4	.000
118.4	.257	118.3	.026	119.4	.000
119.4	.249	119.3	.026	120.4	.000
120.4	.257	120.3	.026	121.4	.000
121.4	.249	121.3	.026	122.4	.000
122.4	.257	122.3	.026	123.4	.000
123.4	.249	123.3	.026	124.4	.000
124.4	.257	124.3	.026	125.4	.000
125.4	.249	125.3	.026	126.4	.000
126.4	.257	126.3	.026	127.4	.000
127.4	.249	127.3	.026	128.4	.000
128.4	.257	128.3	.026	129.4	.000
129.4	.249	129.3	.026	130.4	.000
130.4	.257	130.3	.026	131.4	.000
131.4	.249	131.3	.026	132.4	.000
132.4	.257	132.3	.026	133.4	.000
133.4	.249	133.3	.026	134.4	.000
134.4	.257	134.3	.026	135.4	.000
135.4	.249	135.3	.026	136.4	.000
136.4	.257	136.3	.026	137.4	.000
137.4	.249	137.3	.026	138.4	.000
138.4	.257	138.3	.026	139.4	.000
139.4	.249	139.3	.026	140.4	.000
140.4	.257	140.3	.026	141.4	.000
141.4	.249	141.3	.026	142.4	.000
142.4	.257	142.3	.026	143.4	.000
143.4	.249	143.3	.026	144.4	.000
144.4	.257	144.3	.026	145.4	.000
145.4	.249	145.3	.026	146.4	.000
146.4	.257	146.3	.026	147.4	.000
147.4	.249	147.3	.026	148.4	.000
148.4	.257	148.3	.026	149.4	.000
149.4	.249	149.3	.026	150.4	.000
150.4	.257	150.3	.026	151.4	.000
151.4	.249	151.3	.026	152.4	.000
152.4	.257	152.3	.026	153.4	.000
153.4	.249	153.3	.026	154.4	.000
154.4	.257	154.3	.026	155.4	.000
155.4	.249	155.3	.026	156.4	.000
156.4	.257	156.3	.026	157.4	.000
157.4	.249	157.3	.026	158.4	.000
158.4	.257	158.3	.026	159.4	.000
159.4	.249	159.3	.026	160.4	.000
160.4	.257	160.3	.026	161.4	.000
161.4	.249	161.3	.026	162.4	.000
162.4	.257	162.3	.026	163.4	.000
163.4	.249	163.3	.026	164.4	.000
164.4	.257	164.3	.026	165.4	.000
165.4	.249	165.3	.026	166.4	.000
166.4	.257	166.3	.026	167.4	.000
167.4	.249	167.3	.026	168.4	.000
168.4	.257	168.3	.026	169.4	.000
169.4	.249	169.3	.026	170.4	.000
170.4	.257	170.3	.026	171.4	.000
171.4	.249	171.3	.026	172.4	.000
172.4	.257	172.3	.026	173.4	.000
173.4	.249	173.3	.026	174.4	.000
174.4	.257	174.3	.026	175.4	.000
175.4	.249	175.3	.026	176.4	.000
176.4	.257	176.3	.026	177.4	.000
177.4	.249	177.3	.026	178.4	.000
178.4	.257	178.3	.026	179.4	.000
179.4	.249	179.3	.026	180.4	.000
180.4	.257	180.3	.026	181.4	.000
181.4	.249	181.3	.026	182.4	.000
182.4	.257	182.3	.026	183.4	.000
183.4	.249	183.3	.026	184.4	.000
184.4	.257	184.3	.026	185.4	.000
185.4	.249	185.3	.026	186.4	.000
186.4	.257	186.3	.026	187.4	.000
187.4	.249	187.3	.026	188.4	.000
188.4	.257	188.3	.026	189.4	.000
189.4	.249	189.3	.026	190.4	.000
190.4	.257	190.3	.026	191.4	.000
191.4	.249	191.3	.026	192.4	.000
192.4	.257	192.3	.026	193.4	.000
193.4	.249	193.3	.026	194.4	.000
194.4	.257	194.3	.026	195.4	.000
195.4	.249	195.3	.026	196.4	.000
196.4	.257	196.3	.026	197.4	.000
197.4	.249	197.3	.026	198.4	.000
198.4	.257	198.3	.026	199.4	.000
199.4	.249	199.3	.026	200.4	.000
200.4	.257	200.3	.026	201.4	.000
201.4	.249	201.3	.026	202.4	.000
202.4	.257	202.3	.026	203.4	.000
203.4	.249	203.3	.026	204.4	.000
204.4	.257	204.3	.026	205.4	.000
205.4	.249	205.3	.026	206.4	.000
206.4	.257	206.3	.026	207.4	.000
207.4	.249	207.3	.026	208.4	.000
208.4	.257	208.3	.026	209.4	.000
209.4	.249	209.3	.026	210.4	.000
210.4	.257	210.3	.026	211.4	.000
211.4	.249	211.3	.026	212.4	.000
212.4	.257	212.3	.026	213.4	.000
213.4	.249	213.3	.026	214.4	.000
214.4	.257	214.3	.026	215.4	.000
215.4	.249	215.3	.026	216.4	.000
216.4	.257	216.3	.026	217.4	.000
217.4	.249	217.3	.026	218.4	.000
218.4	.257	218.3	.026	219.4	.000
219.4	.249	219.3	.026	220.4	.000
220.4	.257	220.3	.026	221.4	.000
221.4	.249	221.3	.026	222.4	.000
222.4	.257	222.3	.026	223.4	.000
223.4	.249	223.3	.026	224.4	.000
224.4	.257	224.3	.026	225.4	.000
225.4	.249	225.3	.026	226.4	.000
226.4	.257	226.3	.026	227.4	.000
227.4	.249	227.3	.026	228.4	.000
228.4	.257	228.3	.026	229.4	.000
229.4	.249	229.3	.026	230.4	.000
230.4	.257	230.3	.026	231.4	.000
231.4	.249	231.3	.026	232.4	.000
232.4	.257	232.3	.026	233.4	.000
233.4	.249	233.3	.026	234.4	.000
234.4	.257	234.3	.026	235.4	.000
235.4	.249	235.3	.026	236.4	.000
236.4	.257	236.3	.026	237.4	.000
237.4	.249	237.3	.026	238.4	.000
238.4	.257	238.3	.026	239.4	.000
239.4	.249	239.3	.026	240.4	.000
240.4	.257	240.3	.026	241.4	.000
241.4	.249	241.3	.026	242.4	.000
242.4	.257	242.3	.026	243.4	.000
243.4	.249	243.3	.026	244.4	.000
244.4	.257	244.3	.026	245.4	.000
245.4	.249	245.3	.026	246.4	.000
246.4	.257	246.3	.026	247.4	.000
247.4	.249	247.3	.026	248.4	.000
248.4	.257	248.3	.026	249.4	.000
249.4	.249	249.3	.026	250.4	.000
250.4	.257	250.3	.026	251.4	.000
251.4	.249	251.3	.026	252.4	.000
252.4	.257	252.3	.026	253.4	.000
253.4	.249	253.3	.026	254.4	.000
254.4	.257	254.3	.026	255.4	.000
255.4	.249	255.3	.026	256.4	.000
256.4	.257	256.3	.026	257.4	.000
257.4	.249	257.3</td			

TABLE 11.- Concluded

(f) Angle of scatter of 60°

Energy, MeV	Cross section mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV
.6	.000	.428	.391	.332	.287	.253	.219
4.4	.6	48.0	49.6	50.3	51.5	53.3	56.6
49.0	.6	51.4	51.8	52.6	53.4	54.2	55.7
50.6	.6	53.1	53.9	54.7	55.5	56.3	57.8
52.3	.6	54.9	55.0	55.9	56.6	57.3	58.9
53.0	.6	55.7	55.8	56.6	57.4	58.1	59.7
54.7	.6	56.5	56.6	57.3	58.0	58.7	59.4
56.4	.6	57.3	57.4	58.2	58.9	59.6	60.3
58.1	.6	58.9	59.0	59.8	60.5	61.2	61.9
59.8	.6	59.7	60.0	60.8	61.5	62.2	62.9
61.5	.6	60.5	60.8	61.6	62.3	63.0	63.7
63.2	.6	61.3	61.6	62.4	63.1	63.8	64.5
64.9	.6	62.1	62.4	63.2	63.9	64.6	65.3
66.6	.6	62.9	63.2	64.0	64.7	65.4	66.1
68.3	.6	63.7	64.0	64.8	65.5	66.2	66.9
70.0	.6	64.5	64.8	65.6	66.3	67.0	67.7
71.7	.6	65.3	65.6	66.4	67.1	67.8	68.5
73.4	.6	66.1	66.4	67.2	67.9	68.6	69.3
75.1	.6	66.9	67.2	68.0	68.7	69.4	70.1
76.8	.6	67.7	68.0	68.8	69.5	70.2	70.9
78.5	.6	68.5	68.8	69.6	70.3	71.0	71.7
80.2	.6	69.3	69.6	70.4	71.1	71.8	72.5
81.9	.6	69.7	70.0	70.8	71.5	72.2	72.9
83.6	.6	70.5	70.8	71.6	72.3	73.0	73.7
85.3	.6	71.3	71.6	72.4	73.1	73.8	74.5
87.0	.6	72.1	72.4	73.2	73.9	74.6	75.3
88.7	.6	72.9	73.2	74.0	74.7	75.4	76.1
90.4	.6	73.7	74.0	74.8	75.5	76.2	76.9

TABLE 12.- DOUBLE DIFFERENTIAL CROSS SECTIONS FOR PRODUCTION OF  
SECONDARY PROTONS FROM ALUMINUM TARGET, 1.82 g/cm<sup>2</sup> THICK

[Incident proton energy, 558 Mev]

(a) Angle of scatter of 10°

Energy, MeV	Cross section, mb/sr-MeV						
6.5	.000	6.7	.057	7.5	.10.3	15.0	.040
7.0	.095	7.7	.053	9.0	.11.0	13.9	.040
7.5	.079	8.0	.055	10.6	.11.6	12.7	.039
8.0	.059	8.5	.054	11.2	.11.6	11.1	.037
8.5	.062	9.0	.055	13.6	.12.6	18.9	.035
9.0	.079	9.5	.055	13.9	.13.5	17.5	.035
9.5	.065	10.0	.053	14.5	.14.5	16.9	.035
10.0	.062	10.5	.053	15.7	.15.7	18.4	.035
10.5	.056	11.0	.053	16.9	.16.9	19.4	.035
11.0	.059	11.5	.053	17.4	.17.4	20.0	.035
11.5	.057	12.0	.053	18.0	.18.0	21.5	.035
12.0	.059	12.5	.053	18.4	.18.4	21.9	.035
12.5	.059	13.0	.053	19.0	.19.0	22.4	.035
13.0	.059	13.5	.053	19.5	.19.5	22.6	.035
13.5	.059	14.0	.053	20.0	.20.0	22.9	.035
14.0	.059	14.5	.053	20.5	.20.5	23.7	.035
14.5	.059	15.0	.053	21.0	.21.0	24.7	.035
15.0	.059	15.5	.053	21.5	.21.5	25.4	.035
15.5	.059	16.0	.053	22.0	.22.0	26.0	.035
16.0	.059	16.5	.053	22.5	.22.5	26.5	.035
16.5	.059	17.0	.053	23.0	.23.0	27.0	.035
17.0	.059	17.5	.053	23.5	.23.5	27.5	.035
17.5	.059	18.0	.053	24.0	.24.0	28.0	.035
18.0	.059	18.5	.053	24.5	.24.5	28.5	.035
18.5	.059	19.0	.053	25.0	.25.0	29.0	.035
19.0	.059	19.5	.053	25.5	.25.5	29.5	.035
19.5	.059	20.0	.053	26.0	.26.0	30.0	.035
20.0	.059	20.5	.053	26.5	.26.5	30.5	.035
20.5	.059	21.0	.053	27.0	.27.0	31.0	.035
21.0	.059	21.5	.053	27.5	.27.5	31.5	.035
21.5	.059	22.0	.053	28.0	.28.0	32.0	.035
22.0	.059	22.5	.053	28.5	.28.5	32.5	.035
22.5	.059	23.0	.053	29.0	.29.0	33.0	.035
23.0	.059	23.5	.053	29.5	.29.5	33.5	.035
23.5	.059	24.0	.053	30.0	.30.0	34.0	.035
24.0	.059	24.5	.053	30.5	.30.5	34.5	.035
24.5	.059	25.0	.053	31.0	.31.0	35.0	.035
25.0	.059	25.5	.053	31.5	.31.5	35.5	.035
25.5	.059	26.0	.053	32.0	.32.0	36.0	.035
26.0	.059	26.5	.053	32.5	.32.5	36.5	.035
26.5	.059	27.0	.053	33.0	.33.0	37.0	.035
27.0	.059	27.5	.053	33.5	.33.5	37.5	.035
27.5	.059	28.0	.053	34.0	.34.0	38.0	.035
28.0	.059	28.5	.053	34.5	.34.5	38.5	.035
28.5	.059	29.0	.053	35.0	.35.0	39.0	.035
29.0	.059	29.5	.053	35.5	.35.5	39.5	.035
29.5	.059	30.0	.053	36.0	.36.0	40.0	.035
30.0	.059	30.5	.053	36.5	.36.5	40.5	.035
30.5	.059	31.0	.053	37.0	.37.0	41.0	.035
31.0	.059	31.5	.053	37.5	.37.5	41.5	.035
31.5	.059	32.0	.053	38.0	.38.0	42.0	.035
32.0	.059	32.5	.053	38.5	.38.5	42.5	.035
32.5	.059	33.0	.053	39.0	.39.0	43.0	.035
33.0	.059	33.5	.053	39.5	.39.5	43.5	.035
33.5	.059	34.0	.053	40.0	.40.0	44.0	.035
34.0	.059	34.5	.053	40.5	.40.5	44.5	.035
34.5	.059	35.0	.053	41.0	.41.0	45.0	.035
35.0	.059	35.5	.053	41.5	.41.5	45.5	.035
35.5	.059	36.0	.053	42.0	.42.0	46.0	.035
36.0	.059	36.5	.053	42.5	.42.5	46.5	.035
36.5	.059	37.0	.053	43.0	.43.0	47.0	.035
37.0	.059	37.5	.053	43.5	.43.5	47.5	.035
37.5	.059	38.0	.053	44.0	.44.0	48.0	.035
38.0	.059	38.5	.053	44.5	.44.5	48.5	.035
38.5	.059	39.0	.053	45.0	.45.0	49.0	.035
39.0	.059	39.5	.053	45.5	.45.5	49.5	.035
39.5	.059	40.0	.053	46.0	.46.0	50.0	.035
40.0	.059	40.5	.053	46.5	.46.5	50.5	.035
40.5	.059	41.0	.053	47.0	.47.0	51.0	.035
41.0	.059	41.5	.053	47.5	.47.5	51.5	.035
41.5	.059	42.0	.053	48.0	.48.0	52.0	.035
42.0	.059	42.5	.053	48.5	.48.5	52.5	.035
42.5	.059	43.0	.053	49.0	.49.0	53.0	.035
43.0	.059	43.5	.053	49.5	.49.5	53.5	.035
43.5	.059	44.0	.053	50.0	.50.0	54.0	.035
44.0	.059	44.5	.053	50.5	.50.5	54.5	.035
44.5	.059	45.0	.053	51.0	.51.0	55.0	.035
45.0	.059	45.5	.053	51.5	.51.5	55.5	.035
45.5	.059	46.0	.053	52.0	.52.0	56.0	.035
46.0	.059	46.5	.053	52.5	.52.5	56.5	.035
46.5	.059	47.0	.053	53.0	.53.0	57.0	.035
47.0	.059	47.5	.053	53.5	.53.5	57.5	.035
47.5	.059	48.0	.053	54.0	.54.0	58.0	.035
48.0	.059	48.5	.053	54.5	.54.5	58.5	.035
48.5	.059	49.0	.053	55.0	.55.0	59.0	.035
49.0	.059	49.5	.053	55.5	.55.5	59.5	.035
49.5	.059	50.0	.053	56.0	.56.0	60.0	.035
50.0	.059	50.5	.053	56.5	.56.5	60.5	.035
50.5	.059	51.0	.053	57.0	.57.0	61.0	.035
51.0	.059	51.5	.053	57.5	.57.5	61.5	.035
51.5	.059	52.0	.053	58.0	.58.0	62.0	.035
52.0	.059	52.5	.053	58.5	.58.5	62.5	.035
52.5	.059	53.0	.053	59.0	.59.0	63.0	.035
53.0	.059	53.5	.053	59.5	.59.5	63.5	.035
53.5	.059	54.0	.053	60.0	.60.0	64.0	.035
54.0	.059	54.5	.053	60.5	.60.5	64.5	.035
54.5	.059	55.0	.053	61.0	.61.0	65.0	.035
55.0	.059	55.5	.053	61.5	.61.5	65.5	.035
55.5	.059	56.0	.053	62.0	.62.0	66.0	.035
56.0	.059	56.5	.053	62.5	.62.5	66.5	.035
56.5	.059	57.0	.053	63.0	.63.0	67.0	.035
57.0	.059	57.5	.053	63.5	.63.5	67.5	.035
57.5	.059	58.0	.053	64.0	.64.0	68.0	.035
58.0	.059	58.5	.053	64.5	.64.5	68.5	.035
58.5	.059	59.0	.053	65.0	.65.0	69.0	.035
59.0	.059	59.5	.053	65.5	.65.5	69.5	.035
59.5	.059	60.0	.053	66.0	.66.0	70.0	.035
60.0	.059	60.5	.053	66.5	.66.5	70.5	.035
60.5	.059	61.0	.053	67.0	.67.0	71.0	.035
61.0	.059	61.5	.053	67.5	.67.5	71.5	.035
61.5	.059	62.0	.053	68.0	.68.0	72.0	.035
62.0	.059	62.5	.053	68.5	.68.5	72.5	.035
62.5	.059	63.0	.053	69.0	.69.0	73.0	.035
63.0	.059	63.5	.053	69.5	.69.5	73.5	.035
63.5	.059	64.0	.053	70.0	.70.0	74.0	.035
64.0	.059	64.5	.053	70.5	.70.5	74.5	.035
64.5	.059	65.0	.053	71.0	.71.0	75.0	.035
65.0	.059	65.5	.053	71.5	.71.5	75.5	.035
65.5	.059	66.0	.053	72.0	.72.0	76.0	.035
66.0	.059	66.5	.053	72.5	.72.5	76.5	.035
66.5	.059	67.0	.053	73.0	.73.0	77.0	.035
67.0	.059	67.5	.053	73.5	.73.5	77.5	.035
67.5	.059	68.0	.053	74.0	.74.0	78.0	.035
68.0	.059	68.5	.053	74.5	.74.5	78.5	.035
68.5	.059	69.0	.053	75.0	.75.0	79.0	.035
69.0	.059	69.5	.053	75.5	.75.5	79.5	.035
69.5	.059	70.0	.053	76.0	.76.0	80.0	.035
70.0	.059	70.5	.053	76.5	.76.5	80.5	.035
70.5	.059	71.0	.053	77.0	.77.0	81.0	.035
71.0	.059	71.5	.053	77.5	.77.5	81.5	.035
71.5	.059	72.0	.053	78.0	.78.0	82.0	.035
72.0	.059	72.5	.053	78.5	.78.5	82.5	.035
72.5	.059	73.0	.053	79.0	.79.0	83.0	.035
73.0	.059	73.5	.053	79.5	.79.5	83.5	.035
73.5	.059	74.0	.053	80.0	.80.0	84.0	.035
74.0	.059	74.5	.053	80.5	.80.5	84.5	.035
74.5	.059	75.0	.053	81.0	.81.0	85.0	.035
75.0	.059	75.5	.053	81.5	.81.5	85.5	.035
75.5	.059	76.0	.053	82.0	.82.0	86.0	.035
76.0	.059	76.5	.053	82.5	.82.5	86.5	.035
76.5	.059	77.0	.053	83.0	.83.0	87.0	.035
77.0	.059	77.5	.053	83.5	.83.5	87.5	.035
77.5	.059	78.0	.053	84.0	.84.0	88.0	.035
78.0	.059	78.5	.053	84.5	.84.5	88.5	.035
78.5	.059	79.0	.053	85.0	.85.0	89.0	.035
79.0	.059	79.5	.053	85.5	.85.5	89.5	.035
79.5	.059	80.0	.053	86.0	.86.0	90.0	.035
80.0	.059	80.5	.053	86.5	.86.5	90.5	

TABLE 12.- Continued

(b) Angle of scatter of  $20^\circ$ 

Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV
48.0	.000	1.7	.045	278.9	.027
48.7	.063	1.7	.050	289.5	.024
50.0	.076	1.7	.051	290.9	.025
50.6	.071	1.7	.052	291.5	.025
51.3	.052	1.7	.046	292.1	.025
52.0	.057	1.7	.046	292.7	.025
52.7	.052	1.7	.046	293.3	.025
53.4	.059	1.7	.046	293.9	.025
54.1	.051	1.7	.046	294.5	.025
54.8	.059	1.7	.046	295.1	.025
55.5	.056	1.7	.046	295.7	.025
56.2	.051	1.7	.046	296.3	.025
56.9	.053	1.7	.046	296.9	.025
57.6	.057	1.7	.046	297.5	.025
58.3	.053	1.7	.046	298.1	.025
59.0	.051	1.7	.046	298.7	.025
59.7	.046	1.7	.046	299.3	.025
60.4	.049	1.7	.046	300.0	.025
61.1	.046	1.7	.046	300.6	.025
61.8	.049	1.7	.046	301.3	.025
62.5	.046	1.7	.046	302.0	.025
63.2	.049	1.7	.046	302.7	.025
63.9	.046	1.7	.046	303.4	.025
64.6	.049	1.7	.046	304.1	.025
65.3	.046	1.7	.046	304.8	.025
66.0	.049	1.7	.046	305.5	.025
66.7	.046	1.7	.046	306.2	.025
67.4	.049	1.7	.046	306.9	.025
68.1	.046	1.7	.046	307.6	.025
68.8	.049	1.7	.046	308.3	.025
69.5	.046	1.7	.046	309.0	.025
70.2	.049	1.7	.046	309.7	.025
70.9	.046	1.7	.046	310.4	.025
71.6	.049	1.7	.046	311.1	.025
72.3	.046	1.7	.046	311.8	.025
73.0	.049	1.7	.046	312.5	.025
73.7	.046	1.7	.046	313.2	.025
74.4	.049	1.7	.046	313.9	.025
75.1	.046	1.7	.046	314.6	.025
75.8	.049	1.7	.046	315.3	.025
76.5	.046	1.7	.046	316.0	.025
77.2	.049	1.7	.046	316.7	.025
77.9	.046	1.7	.046	317.4	.025
78.6	.049	1.7	.046	318.1	.025
79.3	.046	1.7	.046	318.8	.025
80.0	.049	1.7	.046	319.5	.025
80.7	.046	1.7	.046	320.2	.025
81.4	.049	1.7	.046	320.9	.025
82.1	.046	1.7	.046	321.6	.025
82.8	.049	1.7	.046	322.3	.025
83.5	.046	1.7	.046	323.0	.025
84.2	.049	1.7	.046	323.7	.025
84.9	.046	1.7	.046	324.4	.025
85.6	.049	1.7	.046	325.1	.025
86.3	.046	1.7	.046	325.8	.025
87.0	.049	1.7	.046	326.5	.025
87.7	.046	1.7	.046	327.2	.025
88.4	.049	1.7	.046	327.9	.025
89.1	.046	1.7	.046	328.6	.025
89.8	.049	1.7	.046	329.3	.025
90.5	.046	1.7	.046	330.0	.025
91.2	.049	1.7	.046	330.7	.025
91.9	.046	1.7	.046	331.4	.025
92.6	.049	1.7	.046	332.1	.025
93.3	.046	1.7	.046	332.8	.025
94.0	.049	1.7	.046	333.5	.025
94.7	.046	1.7	.046	334.2	.025
95.4	.049	1.7	.046	334.9	.025
96.1	.046	1.7	.046	335.6	.025
96.8	.049	1.7	.046	336.3	.025
97.5	.046	1.7	.046	337.0	.025
98.2	.049	1.7	.046	337.7	.025
98.9	.046	1.7	.046	338.4	.025
99.6	.049	1.7	.046	339.1	.025
100.3	.046	1.7	.046	339.8	.025
101.0	.049	1.7	.046	340.5	.025
101.7	.046	1.7	.046	341.2	.025
102.4	.049	1.7	.046	341.9	.025
103.1	.046	1.7	.046	342.6	.025
103.8	.049	1.7	.046	343.3	.025
104.5	.046	1.7	.046	344.0	.025
105.2	.049	1.7	.046	344.7	.025
105.9	.046	1.7	.046	345.4	.025
106.6	.049	1.7	.046	346.1	.025
107.3	.046	1.7	.046	346.8	.025
108.0	.049	1.7	.046	347.5	.025
108.7	.046	1.7	.046	348.2	.025
109.4	.049	1.7	.046	348.9	.025
110.1	.046	1.7	.046	349.6	.025
110.8	.049	1.7	.046	350.3	.025
111.5	.046	1.7	.046	351.0	.025
112.2	.049	1.7	.046	351.7	.025
112.9	.046	1.7	.046	352.4	.025
113.6	.049	1.7	.046	353.1	.025
114.3	.046	1.7	.046	353.8	.025
115.0	.049	1.7	.046	354.5	.025
115.7	.046	1.7	.046	355.2	.025
116.4	.049	1.7	.046	355.9	.025
117.1	.046	1.7	.046	356.6	.025
117.8	.049	1.7	.046	357.3	.025
118.5	.046	1.7	.046	358.0	.025
119.2	.049	1.7	.046	358.7	.025
119.9	.046	1.7	.046	359.4	.025
120.6	.049	1.7	.046	360.1	.025
121.3	.046	1.7	.046	360.8	.025
122.0	.049	1.7	.046	361.5	.025
122.7	.046	1.7	.046	362.2	.025
123.4	.049	1.7	.046	362.9	.025
124.1	.046	1.7	.046	363.6	.025
124.8	.049	1.7	.046	364.3	.025
125.5	.046	1.7	.046	365.0	.025
126.2	.049	1.7	.046	365.7	.025
126.9	.046	1.7	.046	366.4	.025
127.6	.049	1.7	.046	367.1	.025
128.3	.046	1.7	.046	367.8	.025
129.0	.049	1.7	.046	368.5	.025
129.7	.046	1.7	.046	369.2	.025
130.4	.049	1.7	.046	369.9	.025
131.1	.046	1.7	.046	370.6	.025
131.8	.049	1.7	.046	371.3	.025
132.5	.046	1.7	.046	372.0	.025
133.2	.049	1.7	.046	372.7	.025
133.9	.046	1.7	.046	373.4	.025
134.6	.049	1.7	.046	374.1	.025
135.3	.046	1.7	.046	374.8	.025
136.0	.049	1.7	.046	375.5	.025
136.7	.046	1.7	.046	376.2	.025
137.4	.049	1.7	.046	376.9	.025
138.1	.046	1.7	.046	377.6	.025
138.8	.049	1.7	.046	378.3	.025
139.5	.046	1.7	.046	379.0	.025
140.2	.049	1.7	.046	379.7	.025
140.9	.046	1.7	.046	380.4	.025
141.6	.049	1.7	.046	381.1	.025
142.3	.046	1.7	.046	381.8	.025
143.0	.049	1.7	.046	382.5	.025
143.7	.046	1.7	.046	383.2	.025
144.4	.049	1.7	.046	383.9	.025
145.1	.046	1.7	.046	384.6	.025
145.8	.049	1.7	.046	385.3	.025
146.5	.046	1.7	.046	386.0	.025
147.2	.049	1.7	.046	386.7	.025
147.9	.046	1.7	.046	387.4	.025
148.6	.049	1.7	.046	388.1	.025
149.3	.046	1.7	.046	388.8	.025
150.0	.049	1.7	.046	389.5	.025
150.7	.046	1.7	.046	390.2	.025
151.4	.049	1.7	.046	390.9	.025
152.1	.046	1.7	.046	391.6	.025
152.8	.049	1.7	.046	392.3	.025
153.5	.046	1.7	.046	393.0	.025
154.2	.049	1.7	.046	393.7	.025
154.9	.046	1.7	.046	394.4	.025
155.6	.049	1.7	.046	395.1	.025
156.3	.046	1.7	.046	395.8	.025
157.0	.049	1.7	.046	396.5	.025
157.7	.046	1.7	.046	397.2	.025
158.4	.049	1.7	.046	397.9	.025
159.1	.046	1.7	.046	398.6	.025
159.8	.049	1.7	.046	399.3	.025
160.5	.046	1.7	.046	400.0	.025
161.2	.049	1.7	.046	400.7	.025
161.9	.046	1.7	.046	401.4	.025
162.6	.049	1.7	.046	402.1	.025
163.3	.046	1.7	.046	402.8	.025
164.0	.049	1.7	.046	403.5	.025
164.7	.046	1.7	.046	404.2	.025
165.4	.049	1.7	.046	404.9	.025
166.1	.046	1.7	.046	405.6	.025
166.8	.049	1.7	.046	406.3	.025
167.5	.046	1.7	.046	407.0	.025
168.2	.049	1.7	.046	407.7	.025
168.9	.046	1.7	.046	408.4	.025
169.6	.049	1.7	.046	409.1	.025
170.3	.046	1.7	.046	409.8	.025
171.0	.049	1.7	.046	410.5	.025
171.7	.046	1.7	.046	411.2	.025
172.4	.049	1.7	.046	411.9	.025
173.1	.046	1.7	.046	412.6	.025
173.8	.049	1.7	.046	413.3	.025
174.5	.046	1.7	.046	414.0	.025
175.2	.049	1.7	.046	414.7	.025
175.9	.046	1.7	.046	415.4	.025
176.6	.049	1.7	.046	416.1	.025
177.3	.046	1.7	.046	416.8	.025
178.0	.049	1.7	.046	417.5	.025
178.7	.046	1.7	.046	418.2	.025
179.4	.049	1.7	.046	418.9	.025
180.1	.046	1.7	.046	419.6	.025
180.8	.049	1.7	.046	420.3	.025
181.5	.046	1.7	.046	421.0	.025
182.2	.049	1.7	.046	421.7	.025
182.9	.046	1.7	.046	422.4	.025
183.6	.049	1.7	.046	423.1	.025
184.3	.046	1.7	.046	423.8	.025
185.0	.049	1.7	.046	424.5	.025
185.7	.046				

TABLE 12.- Continued

(c) Angle of scatter of  $30^\circ$ 

Energy, MeV	Cross section, mb/sr-MeV						
60.7	.403 ± .036	132.4	.423 ± .035	650.5 ± 46.6	.004 ± .000		
61.6	.403 ± .052	135.5	.402 ± .034	700.4 ± 53.6	.003 ± .000		
62.5	.591 ± .049	138.7	.422 ± .035				
63.5	.556 ± .049	142.1	.425 ± .032				
64.5	.541 ± .052	145.1	.375 ± .032				
65.5	.550 ± .052	149.1	.373 ± .030				
66.5	.588 ± .055	152.6	.356 ± .030				
67.5	.611 ± .056	156.8	.358 ± .027				
68.5	.617 ± .056	160.1	.328 ± .028				
69.5	.63.3	163.5	.347 ± .030				
70.5	.591 ± .051	169.1	.340 ± .028				
71.5	.556 ± .051	174.1	.322 ± .027				
72.5	.541 ± .051	178.1	.328 ± .028				
73.5	.550 ± .051	182.1	.340 ± .030				
74.5	.588 ± .051	186.1	.312 ± .028				
75.5	.611 ± .051	190.1	.305 ± .028				
76.5	.617 ± .051	194.1	.289 ± .025				
77.5	.63.3	198.1	.283 ± .025				
78.5	.591 ± .051	202.1	.285 ± .025				
79.5	.556 ± .051	206.1	.281 ± .027				
80.5	.541 ± .051	210.1	.270 ± .027				
81.5	.550 ± .051	214.1	.281 ± .028				
82.5	.588 ± .051	218.1	.305 ± .028				
83.5	.611 ± .051	222.1	.316 ± .028				
84.5	.617 ± .051	226.1	.329 ± .028				
85.5	.63.3	230.1	.344 ± .027				
86.5	.591 ± .051	234.1	.401 ± .037				
87.5	.556 ± .051	238.1	.419 ± .037				
88.5	.541 ± .051	242.1	.362 ± .028				
89.5	.550 ± .051	246.1	.194 ± .010				
90.5	.588 ± .051	250.1	.049 ± .006				
91.5	.611 ± .051	254.1	.299 ± .028				
92.5	.617 ± .051	258.1	.262 ± .028				
93.5	.63.3	262.1	.236 ± .028				
94.5	.591 ± .051	266.1	.219 ± .028				
95.5	.556 ± .051	270.1	.191 ± .028				
96.5	.541 ± .051	274.1	.162 ± .028				
97.5	.550 ± .051	278.1	.135 ± .028				
98.5	.588 ± .051	282.1	.107 ± .028				
99.5	.611 ± .051	286.1	.081 ± .028				
100.5	.617 ± .051	290.1	.053 ± .028				
101.5	.63.3	294.1	.026 ± .028				
102.5	.591 ± .051	298.1	.000 ± .028				

TABLE 12.- Continued

TABLE 12.- Continued

TABLE 12.- Concluded  
(f) Angle of scatter of 60°

TABLE 13.- DOUBLE DIFFERENTIAL CROSS SECTIONS FOR PRODUCTION OF  
SECONDARY PROTONS FROM IRON TARGET, 3.77 g/cm<sup>2</sup> THICK

[Incident proton energy, 558 MeV]

(a) Angle of scatter of 10°

Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV
47.9 ± .6	.000 ± .000	93.1 ± 1.7	1.005 ± .089	279.5 ± 10.3	.652 ± .058
48.5 ± .6	1.470 ± .116	94.9 ± 1.8	.984 ± .087	290.2 ± 11.0	.618 ± .056
50.5 ± .6	1.285 ± .104	96.6 ± 1.9	.961 ± .085	301.6 ± 11.8	.606 ± .055
52.5 ± .6	1.237 ± .102	98.6 ± 2.0	.927 ± .082	313.8 ± 12.6	.584 ± .053
54.5 ± .6	1.231 ± .103	100.5 ± 2.0	.989 ± .087	326.9 ± 13.4	.559 ± .051
56.5 ± .6	1.153 ± .097	102.5 ± 2.0	.974 ± .086	340.9 ± 14.2	.534 ± .049
58.5 ± .6	1.219 ± .103	104.5 ± 2.0	.962 ± .085	356.1 ± 15.0	.511 ± .047
60.5 ± .6	1.302 ± .111	106.5 ± 2.0	.957 ± .084	372.4 ± 16.8	.491 ± .045
62.5 ± .6	1.185 ± .102	108.5 ± 2.0	.956 ± .085	390.1 ± 18.7	.531 ± .049
64.5 ± .6	1.077 ± .092	111.5 ± 2.0	1.028 ± .082	409.3 ± 20.0	.540 ± .050
66.5 ± .6	1.164 ± .096	113.5 ± 2.0	1.028 ± .091	430.3 ± 21.3	.492 ± .046
68.5 ± .6	1.072 ± .093	115.5 ± 2.0	1.028 ± .092	453.3 ± 24.0	.556 ± .053
70.5 ± .6	1.049 ± .091	118.5 ± 2.0	1.047 ± .083	478.5 ± 26.5	.521 ± .069
72.5 ± .6	1.156 ± .101	121.5 ± 2.0	.976 ± .083	506.5 ± 29.4	.502 ± .059
74.5 ± .6	1.011 ± .089	123.5 ± 2.0	.910 ± .079	537.5 ± 32.7	.502 ± .050
76.5 ± .6	1.086 ± .087	126.5 ± 2.0	.915 ± .080	557.9 ± 36.8	.360 ± .034
78.5 ± .6	1.073 ± .100	129.5 ± 2.0	.892 ± .075	611.3 ± 41.6	.311 ± .035
80.5 ± .6	1.121 ± .103	132.5 ± 2.0	.914 ± .077	655.7 ± 47.7	.010 ± .032
82.5 ± .6	1.061 ± .094	135.5 ± 2.0	.906 ± .076		
84.5 ± .6	1.012 ± .094	138.5 ± 2.0	.927 ± .078		
86.5 ± .6	1.119 ± .099	142.5 ± 2.0	.912 ± .075		
88.5 ± .6	1.132 ± .100	145.5 ± 2.0	.905 ± .075		
90.5 ± .6	1.004 ± .090	149.5 ± 2.0	.947 ± .080		
92.5 ± .6	1.061 ± .094	152.5 ± 2.0	.891 ± .076		
94.5 ± .6	1.012 ± .094	156.5 ± 2.0	.905 ± .077		
96.5 ± .6	1.119 ± .099	159.5 ± 2.0	.888 ± .076		
98.5 ± .6	1.132 ± .100	162.5 ± 2.0	.914 ± .075		
100.5 ± .6	1.004 ± .090	165.5 ± 2.0	.906 ± .076		
102.5 ± .6	1.046 ± .094	168.5 ± 2.0	.927 ± .078		
104.5 ± .6	1.075 ± .095	171.5 ± 2.0	.912 ± .075		
106.5 ± .6	1.008 ± .098	174.5 ± 2.0	.905 ± .075		
108.5 ± .6	1.051 ± .095	178.5 ± 2.0	.877 ± .075		
110.5 ± .6	1.079 ± .098	181.5 ± 2.0	.841 ± .072		
112.5 ± .6	1.146 ± .103	184.5 ± 2.0	.838 ± .072		
114.5 ± .6	1.088 ± .097	187.5 ± 2.0	.764 ± .066		
116.5 ± .6	1.131 ± .101	190.5 ± 2.0	.879 ± .077		
118.5 ± .6	1.139 ± .102	194.5 ± 2.0	.887 ± .078		
120.5 ± .6	1.005 ± .090	200.5 ± 2.0	.848 ± .075		
122.5 ± .6	1.044 ± .094	206.5 ± 2.0	.806 ± .071		
124.5 ± .6	1.025 ± .092	213.2 ± 2.0	.830 ± .073		
126.5 ± .6	1.020 ± .092	220.0 ± 2.0	.810 ± .072		
128.5 ± .6	1.002 ± .090	227.1 ± 2.0	.792 ± .070		
130.5 ± .6	1.004 ± .091	234.7 ± 2.0	.791 ± .070		
132.5 ± .6	1.073 ± .096	242.6 ± 2.0	.768 ± .068		
134.5 ± .6	1.032 ± .092	251.0 ± 2.0	.744 ± .066		
136.5 ± .6	1.019 ± .091	259.9 ± 2.0	.724 ± .065		
138.5 ± .6	1.066 ± .086	269.4 ± 2.0	.672 ± .060		

TABLE 13.- Continued

(b) Angle of scatter of  $20^\circ$ 

Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV
48.0 ± .6	.000 ± .000	93.3 ± 1.7	.079 ± .079	278.9 ± 10.3	.039 ± .039
48.7 ± .6	.137 ± .137	95.9 ± 1.8	.079 ± .079	285.5 ± 10.9	.031 ± .031
49.3 ± .6	.116 ± .116	98.7 ± 1.9	.076 ± .076	300.9 ± 11.7	.037 ± .037
50.0 ± .6	.105 ± .105	100.7 ± 2.0	.075 ± .075	313.0 ± 12.5	.035 ± .035
50.6 ± .6	.097 ± .097	104.7 ± 2.0	.076 ± .076	326.0 ± 13.4	.036 ± .036
51.3 ± .7	.103 ± .103	106.8 ± 2.0	.073 ± .073	339.1 ± 14.5	.037 ± .037
52.0 ± .7	.100 ± .100	109.0 ± 2.0	.073 ± .073	355.1 ± 15.5	.041 ± .041
52.7 ± .7	.097 ± .097	110.9 ± 2.0	.077 ± .077	371.1 ± 16.8	.045 ± .045
53.4 ± .7	.103 ± .103	113.6 ± 2.0	.078 ± .078	388.6 ± 18.2	.050 ± .050
54.1 ± .7	.100 ± .100	116.1 ± 2.0	.077 ± .077	407.7 ± 19.8	.054 ± .054
54.8 ± .7	.096 ± .096	118.6 ± 2.0	.077 ± .077	428.3 ± 21.6	.058 ± .058
55.5 ± .7	.093 ± .093	121.1 ± 2.0	.078 ± .078	451.1 ± 23.7	.062 ± .062
56.2 ± .7	.090 ± .090	123.6 ± 2.0	.078 ± .078	476.7 ± 26.2	.066 ± .066
56.9 ± .7	.089 ± .089	126.6 ± 2.0	.077 ± .077	503.6 ± 28.0	.070 ± .070
57.6 ± .7	.086 ± .086	129.5 ± 2.0	.073 ± .073	533.4 ± 30.3	.074 ± .074
58.3 ± .7	.083 ± .083	132.4 ± 2.0	.073 ± .073	568.9 ± 32.3	.078 ± .078
59.0 ± .7	.080 ± .080	135.5 ± 2.0	.069 ± .069	605.5 ± 34.0	.082 ± .082
59.7 ± .7	.077 ± .077	138.7 ± 2.0	.063 ± .063	640.6 ± 36.2	.086 ± .086
60.4 ± .7	.074 ± .074	142.5 ± 2.0	.063 ± .063	675.6 ± 38.0	.090 ± .090
61.1 ± .7	.071 ± .071	145.9 ± 2.0	.063 ± .063	710.1 ± 39.7	.094 ± .094
61.8 ± .7	.068 ± .068	149.3 ± 2.0	.063 ± .063	745.4 ± 41.4	.098 ± .098
62.5 ± .7	.065 ± .065	152.8 ± 2.0	.063 ± .063	780.4 ± 43.1	.102 ± .102
63.2 ± .7	.062 ± .062	156.3 ± 2.0	.063 ± .063	815.2 ± 44.8	.106 ± .106
63.9 ± .7	.060 ± .060	159.8 ± 2.0	.063 ± .063	850.6 ± 46.5	.110 ± .110
64.6 ± .7	.057 ± .057	163.3 ± 2.0	.063 ± .063	885.0 ± 48.2	.114 ± .114
65.3 ± .7	.054 ± .054	166.8 ± 2.0	.063 ± .063	919.4 ± 49.9	.118 ± .118
66.0 ± .7	.051 ± .051	170.3 ± 2.0	.063 ± .063	954.8 ± 51.6	.122 ± .122
66.7 ± .7	.048 ± .048	173.8 ± 2.0	.063 ± .063	989.2 ± 53.3	.126 ± .126
67.4 ± .7	.045 ± .045	177.3 ± 2.0	.063 ± .063	1023.6 ± 55.0	.130 ± .130
68.1 ± .7	.042 ± .042	180.8 ± 2.0	.063 ± .063	1058.0 ± 56.7	.134 ± .134
68.8 ± .7	.040 ± .040	184.3 ± 2.0	.063 ± .063	1092.4 ± 58.4	.138 ± .138
69.5 ± .7	.037 ± .037	187.8 ± 2.0	.063 ± .063	1126.8 ± 60.1	.142 ± .142
70.2 ± .7	.035 ± .035	191.3 ± 2.0	.063 ± .063	1161.2 ± 61.8	.146 ± .146
70.9 ± .7	.033 ± .033	194.8 ± 2.0	.063 ± .063	1195.6 ± 63.5	.150 ± .150
71.6 ± .7	.031 ± .031	198.3 ± 2.0	.063 ± .063	1230.0 ± 65.2	.154 ± .154
72.3 ± .7	.029 ± .029	201.8 ± 2.0	.063 ± .063	1264.4 ± 66.9	.158 ± .158
73.0 ± .7	.027 ± .027	205.3 ± 2.0	.063 ± .063	1308.8 ± 68.6	.162 ± .162
73.7 ± .7	.025 ± .025	208.8 ± 2.0	.063 ± .063	1343.2 ± 70.3	.166 ± .166
74.4 ± .7	.023 ± .023	212.3 ± 2.0	.063 ± .063	1377.6 ± 72.0	.170 ± .170
75.1 ± .7	.021 ± .021	215.8 ± 2.0	.063 ± .063	1412.0 ± 73.7	.174 ± .174
75.8 ± .7	.019 ± .019	219.3 ± 2.0	.063 ± .063	1446.4 ± 75.4	.178 ± .178
76.5 ± .7	.017 ± .017	222.8 ± 2.0	.063 ± .063	1480.8 ± 77.1	.182 ± .182
77.2 ± .7	.015 ± .015	226.3 ± 2.0	.063 ± .063	1515.2 ± 78.8	.186 ± .186
77.9 ± .7	.013 ± .013	229.8 ± 2.0	.063 ± .063	1549.6 ± 80.5	.190 ± .190
78.6 ± .7	.011 ± .011	233.3 ± 2.0	.063 ± .063	1584.0 ± 82.2	.194 ± .194
79.3 ± .7	.009 ± .009	236.8 ± 2.0	.063 ± .063	1618.4 ± 83.9	.198 ± .198
79.9 ± .7	.007 ± .007	240.3 ± 2.0	.063 ± .063	1652.8 ± 85.6	.202 ± .202
80.6 ± .7	.005 ± .005	243.8 ± 2.0	.063 ± .063	1687.2 ± 87.3	.206 ± .206
81.3 ± .7	.003 ± .003	247.3 ± 2.0	.063 ± .063	1721.6 ± 89.0	.210 ± .210
81.9 ± .7	.001 ± .001	250.8 ± 2.0	.063 ± .063	1756.0 ± 90.7	.214 ± .214
82.6 ± .7	.000 ± .000	254.3 ± 2.0	.063 ± .063	1790.4 ± 92.4	.218 ± .218

TABLE 13.- Continued

(c) Angle of scatter of 30°

Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV
60.7 ± .8	.751 ± .067	132.4 ± 3.0	.617 ± .052	650.5 ± 46.6	.005 ± .000
61.6 ± .9	.840 ± .075	135.5 ± 3.1	.589 ± .049	700.4 ± 53.6	.004 ± .000
62.5 ± .7	.893 ± .079	138.7 ± 3.2	.589 ± .049		
63.5 ± .6	.789 ± .070	142.1 ± 3.3	.590 ± .050		
64.5 ± .4	.872 ± .077	145.5 ± 3.5	.556 ± .047		
65.4 ± .5	.842 ± .075	149.1 ± 3.6	.550 ± .046		
66.5 ± .5	.861 ± .077	152.9 ± 3.8	.560 ± .047		
67.5 ± .6	.901 ± .080	156.8 ± 3.9	.541 ± .046		
68.6 ± .6	.864 ± .078	160.8 ± 4.1	.548 ± .047		
69.7 ± .7	.938 ± .084	165.5 ± 4.1	.488 ± .041		
70.8 ± .8	.873 ± .079	169.1 ± 4.1	.478 ± .041		
71.9 ± .9	.829 ± .074	174.1 ± 4.1	.478 ± .039		
73.1 ± .7	.921 ± .083	178.9 ± 4.1	.486 ± .041		
74.3 ± .6	.908 ± .081	180.2 ± 4.1	.444 ± .038		
75.5 ± .6	.903 ± .080	184.0 ± 4.1	.444 ± .042		
76.7 ± .7	.855 ± .077	194.8 ± 4.1	.469 ± .041		
77.8 ± .8	.797 ± .072	206.7 ± 4.1	.422 ± .038		
78.9 ± .9	.876 ± .079	213.1 ± 4.1	.412 ± .037		
79.4 ± .7	.764 ± .069	219.8 ± 4.1	.411 ± .037		
80.5 ± .6	.833 ± .075	226.9 ± 4.1	.382 ± .036		
81.6 ± .6	.785 ± .070	234.7 ± 4.1	.385 ± .034		
82.7 ± .7	.753 ± .067	242.6 ± 4.1	.383 ± .034		
83.8 ± .8	.808 ± .069	250.5 ± 4.1	.376 ± .034		
84.9 ± .9	.832 ± .069	259.5 ± 4.1	.374 ± .034		
86.0 ± .8	.785 ± 1.0	268.9 ± 4.1	.386 ± .035		
87.1 ± .9	.753 ± 1.0	278.5 ± 4.1	.395 ± .036		
88.2 ± .7	.808 ± 1.0	289.5 ± 4.1	.409 ± .037		
89.3 ± .6	.832 ± 1.0	300.9 ± 4.1	.411 ± .037		
90.4 ± .6	.753 ± 1.0	313.0 ± 4.1	.457 ± .042		
91.6 ± .6	.765 ± 1.0	326.9 ± 4.1	.486 ± .044		
92.7 ± .7	.753 ± 1.0	333.9 ± 4.1	.510 ± .047		
93.8 ± .8	.760 ± 1.0	347.1 ± 4.1	.532 ± .049		
94.9 ± .9	.753 ± 1.0	354.9 ± 4.1	.513 ± .048		
96.0 ± .8	.764 ± 1.0	371.6 ± 4.1	.463 ± .043		
97.1 ± .9	.720 ± 1.0	378.7 ± 4.1	.486 ± .044		
98.2 ± .7	.721 ± 1.0	388.6 ± 4.1	.532 ± .049		
99.3 ± .6	.765 ± 1.0	397.7 ± 4.1	.463 ± .043		
100.4 ± .6	.760 ± 1.0	428.4 ± 4.1	.463 ± .043		
101.5 ± .7	.763 ± 1.0	437.1 ± 4.1	.463 ± .043		
102.6 ± .8	.725 ± 1.0	451.7 ± 4.1	.463 ± .043		
103.7 ± .9	.720 ± 1.0	476.1 ± 4.1	.463 ± .043		
104.8 ± .7	.716 ± 1.0	503.6 ± 4.1	.463 ± .043		
105.9 ± .8	.729 ± 1.0	534.2 ± 4.1	.463 ± .043		
107.0 ± .9	.720 ± 1.0	568.4 ± 4.1	.463 ± .043		
108.1 ± .7	.716 ± 1.0	606.9 ± 4.1	.463 ± .043		
109.2 ± .8	.729 ± 1.0	645.1 ± 4.1	.463 ± .043		
110.3 ± .9	.720 ± 1.0	676.1 ± 4.1	.463 ± .043		
111.4 ± .7	.725 ± 1.0	707.7 ± 4.1	.463 ± .043		
112.5 ± .8	.720 ± 1.0	739.4 ± 4.1	.463 ± .043		
113.6 ± .6	.725 ± 1.0	771.1 ± 4.1	.463 ± .043		
114.7 ± .7	.720 ± 1.0	802.8 ± 4.1	.463 ± .043		
115.8 ± .8	.725 ± 1.0	834.5 ± 4.1	.463 ± .043		
116.9 ± .6	.720 ± 1.0	866.2 ± 4.1	.463 ± .043		
118.0 ± .7	.725 ± 1.0	907.9 ± 4.1	.463 ± .043		
119.1 ± .8	.720 ± 1.0	941.6 ± 4.1	.463 ± .043		
120.2 ± .6	.725 ± 1.0	973.3 ± 4.1	.463 ± .043		
121.3 ± .7	.720 ± 1.0	1005.0 ± 4.1	.463 ± .043		
122.4 ± .8	.725 ± 1.0	1036.7 ± 4.1	.463 ± .043		
123.5 ± .6	.720 ± 1.0	1068.4 ± 4.1	.463 ± .043		
124.6 ± .7	.725 ± 1.0	1100.1 ± 4.1	.463 ± .043		
125.7 ± .8	.720 ± 1.0	1131.8 ± 4.1	.463 ± .043		
126.8 ± .6	.725 ± 1.0	1163.5 ± 4.1	.463 ± .043		
127.9 ± .7	.720 ± 1.0	1195.2 ± 4.1	.463 ± .043		
129.0 ± .8	.725 ± 1.0	1226.9 ± 4.1	.463 ± .043		
130.1 ± .6	.720 ± 1.0	1258.6 ± 4.1	.463 ± .043		
131.2 ± .7	.725 ± 1.0	1290.3 ± 4.1	.463 ± .043		
132.3 ± .8	.720 ± 1.0	1322.0 ± 4.1	.463 ± .043		
133.4 ± .6	.725 ± 1.0	1353.7 ± 4.1	.463 ± .043		
134.5 ± .7	.720 ± 1.0	1385.4 ± 4.1	.463 ± .043		
135.6 ± .8	.725 ± 1.0	1417.1 ± 4.1	.463 ± .043		
136.7 ± .6	.720 ± 1.0	1448.8 ± 4.1	.463 ± .043		
137.8 ± .7	.725 ± 1.0	1480.5 ± 4.1	.463 ± .043		
138.9 ± .8	.720 ± 1.0	1512.2 ± 4.1	.463 ± .043		
140.0 ± .6	.725 ± 1.0	1543.9 ± 4.1	.463 ± .043		
141.1 ± .7	.720 ± 1.0	1575.6 ± 4.1	.463 ± .043		
142.2 ± .8	.725 ± 1.0	1607.3 ± 4.1	.463 ± .043		
143.3 ± .6	.720 ± 1.0	1639.0 ± 4.1	.463 ± .043		
144.4 ± .7	.725 ± 1.0	1670.7 ± 4.1	.463 ± .043		
145.5 ± .8	.720 ± 1.0	1702.4 ± 4.1	.463 ± .043		
146.6 ± .6	.725 ± 1.0	1734.1 ± 4.1	.463 ± .043		
147.7 ± .7	.720 ± 1.0	1765.8 ± 4.1	.463 ± .043		
148.8 ± .8	.725 ± 1.0	1807.5 ± 4.1	.463 ± .043		
149.9 ± .6	.720 ± 1.0	1839.2 ± 4.1	.463 ± .043		
151.0 ± .7	.725 ± 1.0	1870.9 ± 4.1	.463 ± .043		
152.1 ± .8	.720 ± 1.0	1902.6 ± 4.1	.463 ± .043		
153.2 ± .6	.725 ± 1.0	1934.3 ± 4.1	.463 ± .043		
154.3 ± .7	.720 ± 1.0	1966.0 ± 4.1	.463 ± .043		
155.4 ± .8	.725 ± 1.0	2007.7 ± 4.1	.463 ± .043		
156.5 ± .6	.720 ± 1.0	2039.4 ± 4.1	.463 ± .043		
157.6 ± .7	.725 ± 1.0	2071.1 ± 4.1	.463 ± .043		
158.7 ± .8	.720 ± 1.0	2102.8 ± 4.1	.463 ± .043		
159.8 ± .6	.725 ± 1.0	2134.5 ± 4.1	.463 ± .043		
160.9 ± .7	.720 ± 1.0	2166.2 ± 4.1	.463 ± .043		
162.0 ± .8	.725 ± 1.0	2207.9 ± 4.1	.463 ± .043		
163.1 ± .6	.720 ± 1.0	2239.6 ± 4.1	.463 ± .043		
164.2 ± .7	.725 ± 1.0	2271.3 ± 4.1	.463 ± .043		
165.3 ± .8	.720 ± 1.0	2303.0 ± 4.1	.463 ± .043		
166.4 ± .6	.725 ± 1.0	2334.7 ± 4.1	.463 ± .043		
167.5 ± .7	.720 ± 1.0	2366.4 ± 4.1	.463 ± .043		
168.6 ± .8	.725 ± 1.0	2408.1 ± 4.1	.463 ± .043		
169.7 ± .6	.720 ± 1.0	2449.8 ± 4.1	.463 ± .043		
170.8 ± .7	.725 ± 1.0	2481.5 ± 4.1	.463 ± .043		
171.9 ± .8	.720 ± 1.0	2513.2 ± 4.1	.463 ± .043		
173.0 ± .6	.725 ± 1.0	2544.9 ± 4.1	.463 ± .043		
174.1 ± .7	.720 ± 1.0	2576.6 ± 4.1	.463 ± .043		
175.2 ± .8	.725 ± 1.0	2608.3 ± 4.1	.463 ± .043		
176.3 ± .6	.720 ± 1.0	2640.0 ± 4.1	.463 ± .043		
177.4 ± .7	.725 ± 1.0	2671.7 ± 4.1	.463 ± .043		
178.5 ± .8	.720 ± 1.0	2703.4 ± 4.1	.463 ± .043		
179.6 ± .6	.725 ± 1.0	2735.1 ± 4.1	.463 ± .043		
180.7 ± .7	.720 ± 1.0	2766.8 ± 4.1	.463 ± .043		
181.8 ± .8	.725 ± 1.0	2808.5 ± 4.1	.463 ± .043		
182.9 ± .6	.720 ± 1.0	2840.2 ± 4.1	.463 ± .043		
184.0 ± .7	.725 ± 1.0	2871.9 ± 4.1	.463 ± .043		
185.1 ± .8	.720 ± 1.0	2903.6 ± 4.1	.463 ± .043		
186.2 ± .6	.725 ± 1.0	2935.3 ± 4.1	.463 ± .043		
187.3 ± .7	.720 ± 1.0	2967.0 ± 4.1	.463 ± .043		
188.4 ± .8	.725 ± 1.0	3008.7 ± 4.1	.463 ± .043		
189.5 ± .6	.720 ± 1.0	3040.4 ± 4.1	.463 ± .043		
190.6 ± .7	.725 ± 1.0	3082.1 ± 4.1	.463 ± .043		
191.7 ± .8	.720 ± 1.0	3123.8 ± 4.1	.463 ± .043		
192.8 ± .6	.725 ± 1.0	3165.5 ± 4.1	.463 ± .043		
193.9 ± .7	.720 ± 1.0	3207.2 ± 4.1	.463 ± .043		
195.0 ± .8	.725 ± 1.0	3248.9 ± 4.1	.463 ± .043		
196.1 ± .6	.720 ± 1.0	3290.6 ± 4.1	.463 ± .043		
197.2 ± .7	.725 ± 1.0	3332.3 ± 4.1	.463 ± .043		
198.3 ± .8	.720 ± 1.0	3374.0 ± 4.1	.463 ± .043		
199.4 ± .6	.725 ± 1.0	3415.7 ± 4.1	.463 ± .043		
200.5 ± .7	.720 ± 1.0	3457.4 ± 4.1	.463 ± .043		
201.6 ± .8	.725 ± 1.0	3500.1 ± 4.1	.463 ± .043		
202.7 ± .6	.720 ± 1.0	3541.8 ± 4.1	.463 ± .043		
203.8 ± .7	.725 ± 1.0	3583.5 ± 4.1	.463 ± .043		
204.9 ± .8	.720 ± 1.0	3625.2 ± 4.1	.463 ± .043		
206.0 ± .6	.725 ± 1.0	3666.9 ± 4.1	.463 ± .043		
207.1 ± .7	.720 ± 1.0	3708.6 ± 4.1	.463 ± .043		
208.2 ± .8	.725 ± 1.0	3750.3 ± 4.1	.463 ± .043		
209.3 ± .6	.720 ± 1.0	3792.0 ± 4.1	.463 ± .043		
210.4 ± .7	.725 ± 1.0	3833.7 ± 4.1	.463 ± .043		
211.5 ± .8	.720 ± 1.0	3875.4 ± 4.1	.463 ± .043		
212.6 ± .6	.725 ± 1.0	3917.1 ± 4.1	.463 ± .043		
213.7 ± .7	.720 ± 1.0	3958.8 ± 4.1	.463 ± .043		
214.8 ± .8	.725 ± 1.0	4000.5 ± 4.1	.463 ± .043		
215.9 ± .6	.720 ± 1.0	4042.2 ± 4.1	.463 ± .043		
217.0 ± .7	.725 ± 1.0	4083.9 ± 4.1	.463 ± .043		
218.1 ± .8	.720 ± 1.0	4125.6 ± 4.1	.463 ± .043		
219.2 ± .6	.725 ± 1.0	4167.3 ± 4.1	.463 ± .043		
220.3 ± .7	.720 ± 1.0	4209.0 ± 4.1	.463 ± .043		
221.4 ± .8	.725 ± 1.0	4250.7 ± 4.1	.463 ± .043		
222.5 ± .6	.720 ± 1.0	4292.4 ± 4.1	.463 ± .043		
223.6 ± .7	.725 ± 1.0	4334.1 ± 4.1	.463 ± .043		
224.7 ± .8	.720 ± 1.0	4375.8 ± 4.1	.463 ± .043		
225.8 ± .6	.725 ± 1.0	4417.5 ± 4.1	.463 ± .043		
226.9 ± .7	.720 ± 1.0	4459.2 ± 4.1	.463 ± .043		
228.0 ± .8	.725 ± 1.0	4500.9 ± 4.1	.463 ± .043		
229.1 ± .6	.720 ± 1.0	4542.6 ± 4.1	.463 ± .043		
230.2 ± .7	.725 ± 1.0	4584.3 ± 4.1	.463 ± .043		
231.3 ± .8	.720 ± 1.0	4626.0 ± 4.1	.463 ± .043		
232.4 ± .6	.725 ± 1.0	4667.7 ± 4.1	.463 ± .043		
233.5 ± .7	.720 ± 1.0	4709.4 ± 4.1	.463 ± .043		
234.6 ± .8	.725 ± 1.0	4751.1 ± 4.1	.463 ± .043		
235.7 ± .6	.720 ± 1.0	4792.8 ± 4.1	.463 ± .043		
236.8 ± .7	.725 ± 1.0	4834.5 ± 4.1	.463 ± .043		
237.9 ± .8	.720 ± 1.0	4876.2 ± 4.1	.463 ± .043		
239.0 ± .6	.725 ± 1.0	4917.9 ± 4.1	.463 ± .043		
240.1 ± .7					

TABLE 13.- Continued  
(d) Angle of scatter of  $40^\circ$

Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV
48.4	.000	94.1	.759	283.6	.395
49.6	.000	95.9	.737	294.5	.388
50.3	.000	97.8	.733	306.2	.365
51.0	.000	101.6	.721	318.6	.343
51.7	.000	103.6	.703	320.0	.319
52.4	.000	105.7	.702	322.0	.297
53.1	.000	107.9	.693	318.6	.287
53.8	.000	110.1	.691	316.9	.253
54.6	.000	112.4	.678	316.9	.253
55.3	.000	114.8	.667	317.4	.253
56.1	.000	117.2	.675	317.4	.253
56.9	.000	119.8	.659	317.4	.253
57.7	.000	122.4	.646	317.4	.253
58.4	.000	125.1	.621	317.4	.253
59.2	.000	127.9	.638	317.4	.253
59.9	.000	130.9	.618	317.4	.253
60.7	.000	133.9	.610	317.4	.253
61.4	.000	137.0	.594	317.4	.253
62.1	.000	140.3	.617	317.4	.253
62.8	.000	143.7	.617	317.4	.253
63.5	.000	147.2	.585	317.4	.253
64.2	.000	150.9	.576	317.4	.253
65.0	.000	154.7	.566	317.4	.253
65.8	.000	158.6	.542	317.4	.253
66.6	.000	162.8	.535	317.4	.253
67.3	.000	167.1	.530	317.4	.253
68.1	.000	171.6	.521	317.4	.253
68.9	.000	176.3	.501	317.4	.253
69.7	.000	181.2	.493	317.4	.253
70.5	.000	186.4	.485	317.4	.253
71.2	.000	191.7	.478	317.4	.253
72.0	.000	197.4	.482	317.4	.253
72.7	.000	203.3	.467	317.4	.253
73.5	.000	209.5	.452	317.4	.253
74.2	.000	216.1	.460	317.4	.253
75.0	.000	223.0	.440	317.4	.253
75.7	.000	230.2	.443	317.4	.253
76.4	.000	237.9	.430	317.4	.253
77.2	.000	246.0	.431	317.4	.253
78.0	.000	254.6	.413	317.4	.253
78.8	.000	263.7	.409	317.4	.253
79.5	.000	273.3	.389	317.4	.253
80.3	.000	282.4	.367	317.4	.253
81.1	.000	284.7	.349	317.4	.253
81.9	.000	285.9	.339	317.4	.253
82.7	.000	287.5	.328	317.4	.253
83.5	.000	289.1	.316	317.4	.253
84.3	.000	290.7	.303	317.4	.253
85.1	.000	292.3	.290	317.4	.253
85.9	.000	293.9	.277	317.4	.253
86.7	.000	295.5	.264	317.4	.253
87.5	.000	297.1	.251	317.4	.253
88.3	.000	298.7	.238	317.4	.253
89.1	.000	300.3	.225	317.4	.253
89.9	.000	301.9	.212	317.4	.253
90.7	.000	303.5	.200	317.4	.253
91.5	.000	305.1	.187	317.4	.253
92.3	.000	306.7	.175	317.4	.253
93.1	.000	308.3	.162	317.4	.253
93.9	.000	309.9	.150	317.4	.253
94.7	.000	311.5	.138	317.4	.253
95.5	.000	313.1	.125	317.4	.253
96.3	.000	314.7	.113	317.4	.253
97.1	.000	316.3	.101	317.4	.253
97.9	.000	317.9	.089	317.4	.253
98.7	.000	319.5	.077	317.4	.253
99.5	.000	321.1	.065	317.4	.253
100.3	.000	322.7	.053	317.4	.253
101.1	.000	324.3	.041	317.4	.253
101.9	.000	325.9	.030	317.4	.253
102.7	.000	327.5	.020	317.4	.253
103.5	.000	329.1	.010	317.4	.253
104.3	.000	330.7	.000	317.4	.253
105.1	.000	332.3	.000	317.4	.253
105.9	.000	333.9	.000	317.4	.253
106.7	.000	335.5	.000	317.4	.253
107.5	.000	337.1	.000	317.4	.253
108.3	.000	338.7	.000	317.4	.253
109.1	.000	340.3	.000	317.4	.253
110.0	.000	341.9	.000	317.4	.253
110.8	.000	343.5	.000	317.4	.253
111.6	.000	345.1	.000	317.4	.253
112.4	.000	346.7	.000	317.4	.253
113.2	.000	348.3	.000	317.4	.253
114.0	.000	349.9	.000	317.4	.253
114.8	.000	351.5	.000	317.4	.253
115.6	.000	353.1	.000	317.4	.253
116.4	.000	354.7	.000	317.4	.253
117.2	.000	356.3	.000	317.4	.253
118.0	.000	357.9	.000	317.4	.253
118.8	.000	359.5	.000	317.4	.253
119.6	.000	361.1	.000	317.4	.253
120.4	.000	362.7	.000	317.4	.253
121.2	.000	364.3	.000	317.4	.253
122.0	.000	365.9	.000	317.4	.253
122.8	.000	367.5	.000	317.4	.253
123.6	.000	369.1	.000	317.4	.253
124.4	.000	370.7	.000	317.4	.253
125.2	.000	372.3	.000	317.4	.253
126.0	.000	373.9	.000	317.4	.253
126.8	.000	375.5	.000	317.4	.253
127.6	.000	377.1	.000	317.4	.253
128.4	.000	378.7	.000	317.4	.253
129.2	.000	380.3	.000	317.4	.253
130.0	.000	381.9	.000	317.4	.253
130.8	.000	383.5	.000	317.4	.253
131.6	.000	385.1	.000	317.4	.253
132.4	.000	386.7	.000	317.4	.253
133.2	.000	388.3	.000	317.4	.253
134.0	.000	389.9	.000	317.4	.253
134.8	.000	391.5	.000	317.4	.253
135.6	.000	393.1	.000	317.4	.253
136.4	.000	394.7	.000	317.4	.253
137.2	.000	396.3	.000	317.4	.253
138.0	.000	397.9	.000	317.4	.253
138.8	.000	399.5	.000	317.4	.253
139.6	.000	401.1	.000	317.4	.253
140.4	.000	402.7	.000	317.4	.253
141.2	.000	404.3	.000	317.4	.253
142.0	.000	405.9	.000	317.4	.253
142.8	.000	407.5	.000	317.4	.253
143.6	.000	409.1	.000	317.4	.253
144.4	.000	410.7	.000	317.4	.253
145.2	.000	412.3	.000	317.4	.253
146.0	.000	413.9	.000	317.4	.253
146.8	.000	415.5	.000	317.4	.253
147.6	.000	417.1	.000	317.4	.253
148.4	.000	418.7	.000	317.4	.253
149.2	.000	420.3	.000	317.4	.253
150.0	.000	421.9	.000	317.4	.253
150.8	.000	423.5	.000	317.4	.253
151.6	.000	425.1	.000	317.4	.253
152.4	.000	426.7	.000	317.4	.253
153.2	.000	428.3	.000	317.4	.253
154.0	.000	429.9	.000	317.4	.253
154.8	.000	431.5	.000	317.4	.253
155.6	.000	433.1	.000	317.4	.253
156.4	.000	434.7	.000	317.4	.253
157.2	.000	436.3	.000	317.4	.253
158.0	.000	437.9	.000	317.4	.253
158.8	.000	439.5	.000	317.4	.253
159.6	.000	441.1	.000	317.4	.253
160.4	.000	442.7	.000	317.4	.253
161.2	.000	444.3	.000	317.4	.253
162.0	.000	445.9	.000	317.4	.253
162.8	.000	447.5	.000	317.4	.253
163.6	.000	449.1	.000	317.4	.253
164.4	.000	450.7	.000	317.4	.253
165.2	.000	452.3	.000	317.4	.253
166.0	.000	453.9	.000	317.4	.253
166.8	.000	455.5	.000	317.4	.253
167.6	.000	457.1	.000	317.4	.253
168.4	.000	458.7	.000	317.4	.253
169.2	.000	460.3	.000	317.4	.253
170.0	.000	461.9	.000	317.4	.253
170.8	.000	463.5	.000	317.4	.253
171.6	.000	465.1	.000	317.4	.253
172.4	.000	466.7	.000	317.4	.253
173.2	.000	468.3	.000	317.4	.253
174.0	.000	469.9	.000	317.4	.253
174.8	.000	471.5	.000	317.4	.253
175.6	.000	473.1	.000	317.4	.253
176.4	.000	474.7	.000	317.4	.253
177.2	.000	476.3	.000	317.4	.253
178.0	.000	477.9	.000	317.4	.253
178.8	.000	479.5	.000	317.4	.253
179.6	.000	481.1	.000	317.4	.253
180.4	.000	482.7	.000	317.4	.253
181.2	.000	484.3	.000	317.4	.253
182.0	.000	485.9	.000	317.4	.253
182.8	.000	487.5	.000	317.4	.253
183.6	.000	489.1	.000	317.4	.253
184.4	.000	490.7	.000	317.4	.253
185.2	.000	492.3	.000	317.4	.253
186.0	.000	493.9	.000	317.4	.253
186.8	.000	495.5	.000	317.4	.253
187.6	.000	497.1	.000	317.4	.253
188.4	.000	498.7	.000	317.4	.253
189.2	.000	500.3	.000	317.4	.253
190.0	.000	501.9	.000	317.4	.253
190.8	.000	503.5	.000	317.4	.253
191.6	.000	505.1	.000	317.4	.253
192.4	.000	506.7	.000	317.4	.253
193.2	.000	508.3	.000	317.4	.253
194.0	.000	509.9	.000	317.4	.253
194.8	.000	511.5	.000	317.4	.253
195.6	.000	513.1	.000	317.4	.253
196.4	.000	514.7	.000	317.4	.253
197.2	.000	516.3	.000	317.4	.253
198.0	.000	517.9	.000	317.4	.25

TABLE 13.- Continued  
(e) Angle of scatter of 50°

Energy, MeV	Cross section, mb/sr-MeV						
48.4	.6	94.1	.7	737	.065	283.6	.10.5
49.0	.6	95.9	.8	725	.064	294.5	.11.2
49.6	.6	97.8	.8	709	.063	306.2	.12.0
50.3	.6	99.7	.9	690	.061	318.6	.12.9
51.0	.6	101.6	.9	672	.059	332.0	.13.8
51.7	.6	103.6	.9	665	.060	346.4	.14.9
52.4	.7	105.7	.9	666	.060	361.9	.16.1
53.1	.7	107.9	.9	675	.059	378.6	.17.4
53.8	.7	110.1	.9	668	.059	396.8	.18.9
54.5	.7	112.4	.9	682	.061	416.5	.20.6
55.2	.7	114.8	.9	661	.058	438.1	.22.5
55.9	.7	117.2	.9	619	.057	461.7	.24.7
56.6	.8	119.8	.9	640	.056	487.7	.27.3
57.3	.8	122.4	.9	605	.053	516.5	.30.3
58.0	.8	125.1	.9	608	.053	548.6	.33.9
58.6	.8	127.9	.9	580	.051	584.5	.38.1
59.3	.8	130.9	.9	587	.049	625.1	.43.2
59.9	.8	133.9	.9	573	.048	671.2	.49.4
60.6	.8	137.0	.9	558	.047		
61.2	.8	140.3	.9	559	.047		
61.9	.8	143.7	.9	556	.047		
62.6	.8	147.2	.9	556	.045		
63.3	.8	150.9	.9	537	.045		
64.0	.8	154.7	.9	506	.043		
64.7	.8	158.6	.9	506	.043		
65.4	.8	162.4	.9	485	.041		
66.0	.8	167.8	.9	476	.041		
66.7	.8	171.6	.9	445	.038		
67.4	.8	176.3	.9	438	.037		
68.0	.8	180.4	.9	416	.036		
68.7	.8	184.2	.9	403	.035		
69.4	.8	188.0	.9	390	.034		
70.1	.8	191.7	.9	373	.032		
70.8	.8	195.5	.9	356	.031		
71.5	.8	203.3	.9	352	.031		
72.2	.8	216.1	.9	322	.028		
72.9	.8	223.9	.9	311	.027		
73.6	.8	230.2	.9	287	.025		
74.3	.8	237.9	.9	267	.023		
75.0	.8	246.0	.9	253	.022		
75.7	.8	254.6	.9	230	.020		
76.4	.8	263.3	.9	200	.018		
77.1	.9	111.1	.1	111.1	.1	111.1	.1
77.8	.9	111.1	.1	111.1	.1	111.1	.1
78.5	.9	111.1	.1	111.1	.1	111.1	.1
79.2	.9	111.1	.1	111.1	.1	111.1	.1
79.9	.9	111.1	.1	111.1	.1	111.1	.1
80.6	.9	111.1	.1	111.1	.1	111.1	.1
81.3	.9	111.1	.1	111.1	.1	111.1	.1
82.0	.9	111.1	.1	111.1	.1	111.1	.1
82.7	.9	111.1	.1	111.1	.1	111.1	.1
83.4	.9	111.1	.1	111.1	.1	111.1	.1
84.1	.9	111.1	.1	111.1	.1	111.1	.1
84.8	.9	111.1	.1	111.1	.1	111.1	.1
85.5	.9	111.1	.1	111.1	.1	111.1	.1
86.2	.9	111.1	.1	111.1	.1	111.1	.1
86.9	.9	111.1	.1	111.1	.1	111.1	.1
87.6	.9	111.1	.1	111.1	.1	111.1	.1
88.3	.9	111.1	.1	111.1	.1	111.1	.1
89.0	.9	111.1	.1	111.1	.1	111.1	.1
89.7	.9	111.1	.1	111.1	.1	111.1	.1
90.4	.9	111.1	.1	111.1	.1	111.1	.1
91.1	.9	111.1	.1	111.1	.1	111.1	.1
91.8	.9	111.1	.1	111.1	.1	111.1	.1
92.5	.9	111.1	.1	111.1	.1	111.1	.1

TABLE 13.- Concluded  
(f) Angle of scatter of 60°

Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV
48.4	.000	54.1	.053	283.6	.005
49.0	.000	55.9	.053	294.5	.004
49.6	.078	55.9	.053	294.5	.004
50.3	.978	55.9	.053	306.2	.004
51.0	.917	55.9	.053	318.6	.003
51.7	.075	55.9	.053	332.0	.003
52.4	.926	55.9	.053	346.4	.002
53.1	.077	55.9	.053	361.9	.002
53.8	.856	55.9	.053	378.6	.001
54.5	.070	55.9	.053	396.8	.001
55.2	.831	55.9	.053	416.5	.000
55.9	.073	55.9	.053	438.1	.000
56.6	.823	55.9	.053	461.7	.000
57.3	.070	55.9	.053	487.7	.000
58.0	.823	55.9	.053	516.5	.000
58.7	.068	55.9	.053	548.6	.000
59.4	.791	55.9	.053	584.1	.000
59.0	.066	55.9	.053	625.1	.000
59.7	.761	55.9	.053	671.2	.000
60.4	.065	55.9	.053		
61.1	.814	55.9	.053		
61.8	.740	55.9	.053		
62.5	.064	55.9	.053		
63.2	.765	55.9	.053		
63.9	.067	55.9	.053		
64.6	.727	55.9	.053		
65.3	.063	55.9	.053		
66.0	.763	55.9	.053		
66.7	.068	55.9	.053		
67.4	.715	55.9	.053		
68.1	.064	55.9	.053		
68.8	.715	55.9	.053		
69.5	.065	55.9	.053		
70.2	.702	55.9	.053		
70.9	.065	55.9	.053		
71.6	.666	55.9	.053		
72.3	.743	55.9	.053		
73.0	.066	55.9	.053		
73.7	.743	55.9	.053		
74.4	.066	55.9	.053		
75.1	.666	55.9	.053		
75.8	.743	55.9	.053		
76.5	.066	55.9	.053		
77.2	.666	55.9	.053		
77.9	.743	55.9	.053		
78.6	.066	55.9	.053		
79.3	.666	55.9	.053		
80.0	.743	55.9	.053		
80.7	.066	55.9	.053		
81.4	.666	55.9	.053		
82.1	.743	55.9	.053		
82.8	.066	55.9	.053		
83.5	.666	55.9	.053		
84.2	.743	55.9	.053		
84.9	.066	55.9	.053		
85.6	.666	55.9	.053		
86.3	.743	55.9	.053		
87.0	.066	55.9	.053		
87.7	.666	55.9	.053		
88.4	.743	55.9	.053		
89.1	.066	55.9	.053		
89.8	.666	55.9	.053		
90.5	.743	55.9	.053		
91.2	.066	55.9	.053		
91.9	.666	55.9	.053		
92.6	.743	55.9	.053		
93.3	.066	55.9	.053		
94.0	.666	55.9	.053		
94.7	.743	55.9	.053		
95.4	.066	55.9	.053		
96.1	.666	55.9	.053		
96.8	.743	55.9	.053		
97.5	.066	55.9	.053		
98.2	.666	55.9	.053		
98.9	.743	55.9	.053		
99.6	.066	55.9	.053		
100.3	.666	55.9	.053		
101.0	.743	55.9	.053		
101.7	.066	55.9	.053		
102.4	.666	55.9	.053		
103.1	.743	55.9	.053		
103.8	.066	55.9	.053		
104.5	.666	55.9	.053		
105.2	.743	55.9	.053		
105.9	.066	55.9	.053		
106.6	.666	55.9	.053		
107.3	.743	55.9	.053		
108.0	.066	55.9	.053		
108.7	.666	55.9	.053		
109.4	.743	55.9	.053		
110.1	.066	55.9	.053		
110.8	.666	55.9	.053		
111.5	.743	55.9	.053		
112.2	.066	55.9	.053		
112.9	.666	55.9	.053		
113.6	.743	55.9	.053		
114.3	.066	55.9	.053		
115.0	.666	55.9	.053		
115.7	.743	55.9	.053		
116.4	.066	55.9	.053		
117.1	.666	55.9	.053		
117.8	.743	55.9	.053		
118.5	.066	55.9	.053		
119.2	.666	55.9	.053		
119.9	.743	55.9	.053		
120.6	.066	55.9	.053		
121.3	.666	55.9	.053		
122.0	.743	55.9	.053		
122.7	.066	55.9	.053		
123.4	.666	55.9	.053		
124.1	.743	55.9	.053		
124.8	.066	55.9	.053		
125.5	.666	55.9	.053		
126.2	.743	55.9	.053		
126.9	.066	55.9	.053		
127.6	.666	55.9	.053		
128.3	.743	55.9	.053		
129.0	.066	55.9	.053		
129.7	.666	55.9	.053		
130.4	.743	55.9	.053		
131.1	.066	55.9	.053		
131.8	.666	55.9	.053		
132.5	.743	55.9	.053		
133.2	.066	55.9	.053		
133.9	.666	55.9	.053		
134.6	.743	55.9	.053		
135.3	.066	55.9	.053		
136.0	.666	55.9	.053		
136.7	.743	55.9	.053		
137.4	.066	55.9	.053		
138.1	.666	55.9	.053		
138.8	.743	55.9	.053		
139.5	.066	55.9	.053		
140.2	.666	55.9	.053		
140.9	.743	55.9	.053		
141.6	.066	55.9	.053		
142.3	.666	55.9	.053		
143.0	.743	55.9	.053		
143.7	.066	55.9	.053		
144.4	.666	55.9	.053		
145.1	.743	55.9	.053		
145.8	.066	55.9	.053		
146.5	.666	55.9	.053		
147.2	.743	55.9	.053		
147.9	.066	55.9	.053		
148.6	.666	55.9	.053		
149.3	.743	55.9	.053		
150.0	.066	55.9	.053		
150.7	.666	55.9	.053		
151.4	.743	55.9	.053		
152.1	.066	55.9	.053		
152.8	.666	55.9	.053		
153.5	.743	55.9	.053		
154.2	.066	55.9	.053		
154.9	.666	55.9	.053		
155.6	.743	55.9	.053		
156.3	.066	55.9	.053		
157.0	.666	55.9	.053		
157.7	.743	55.9	.053		
158.4	.066	55.9	.053		
159.1	.666	55.9	.053		
159.8	.743	55.9	.053		
160.5	.066	55.9	.053		
161.2	.666	55.9	.053		
161.9	.743	55.9	.053		
162.6	.066	55.9	.053		
163.3	.666	55.9	.053		
164.0	.743	55.9	.053		
164.7	.066	55.9	.053		
165.4	.666	55.9	.053		
166.1	.743	55.9	.053		
166.8	.066	55.9	.053		
167.5	.666	55.9	.053		
168.2	.743	55.9	.053		
168.9	.066	55.9	.053		
169.6	.666	55.9	.053		
170.3	.743	55.9	.053		
171.0	.066	55.9	.053		
171.7	.666	55.9	.053		
172.4	.743	55.9	.053		
173.1	.066	55.9	.053		
173.8	.666	55.9	.053		
174.5	.743	55.9	.053		
175.2	.066	55.9	.053		
175.9	.666	55.9	.053		
176.6	.743	55.9	.053		
177.3	.066	55.9	.053		
178.0	.666	55.9	.053		
178.7	.743	55.9	.053		
179.4	.066	55.9	.053		
180.1	.666	55.9	.053		
180.8	.743	55.9	.053		
181.5	.066	55.9	.053		
182.2	.666	55.9	.053		
182.9	.743	55.9	.053		
183.6	.066	55.9	.053		
184.3	.666	55.9	.053		
185.0	.743	55.9	.053		
185.7	.066	55.9	.053		
186.4	.666	55.9	.053		
187.1	.743	55.9	.053		
187.8	.066	55.9	.053		
188.5	.666	55.9	.053		
189.2	.743	55.9	.053		
189.9	.066	55.9	.053		
190.6	.666	55.9	.053		
191.3	.743	55.9	.053		
192.0	.066	55.9	.053		
192.7	.666	55.9	.053		
193.4	.743	55.9	.053		
194.1	.066	55.9	.053		
194.8	.666	55.9	.053		
195.5	.743	55.9	.053		
196.2	.066	55.9	.053		
196.9	.666	55.9	.053		
197.6	.743	55.9	.053		
198.3	.066	55.9	.053		
199.0	.666	55.9	.053		
199.7	.743	55.9	.053		
200.4	.066	55.9	.053		
201.1	.666	55.9	.053		
201.8	.743	55.9	.053		
202.5	.066	55.9	.053		
203.2	.666	55.9	.053		
203.9	.743	55.9	.053		
204.6	.066	55.9	.053		
205.3	.666	55.9	.053		
206.0	.743	55.9	.053		
206.7	.066	55.9	.053		
207.4	.666	55.9	.053		
208.1	.743	55			

TABLE 14.- DOUBLE DIFFERENTIAL CROSS SECTIONS FOR PRODUCTION OF  
SECONDARY PROTONS FROM COPPER TARGET, 2.79 g/cm<sup>2</sup> THICK

[Incident proton energy, 558 MeV]

(a) Angle of scatter of 10°

Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV
47.9 ± .6	.482 ± .116	93.1 ± 1.7	1.203 ± .107	279.5 ± 10.3	.714 ± .065
48.5 ± .6	.678 ± .123	94.9 ± 1.8	1.148 ± .102	290.2 ± 11.0	.689 ± .063
49.1 ± .6	.526 ± .111	96.7 ± 1.9	1.110 ± .098	301.6 ± 11.8	.696 ± .063
49.7 ± .6	.351 ± .104	98.6 ± 1.9	1.111 ± .098	313.8 ± 12.6	.636 ± .058
50.3 ± .6	.244 ± .106	100.5 ± 2.0	1.169 ± .103	326.9 ± 13.5	.622 ± .057
50.9 ± .6	.153 ± .093	102.4 ± 2.0	1.146 ± .101	340.5 ± 14.5	.589 ± .054
51.5 ± .6	.093 ± .099	104.6 ± 2.0	1.161 ± .102	356.1 ± 15.7	.556 ± .051
52.1 ± .6	.030 ± .112	106.7 ± 2.0	1.120 ± .099	372.4 ± 16.9	.527 ± .049
52.7 ± .6	.276 ± 1.10	108.9 ± 2.0	1.116 ± .098	390.1 ± 18.4	.549 ± .055
53.3 ± .6	.147 ± .099	111.2 ± 2.0	1.099 ± .095	409.3 ± 20.0	.625 ± .059
53.9 ± .6	.099 ± .110	113.5 ± 2.0	1.071 ± .095	430.3 ± 21.9	.546 ± .052
54.5 ± .6	.059 ± .099	115.9 ± 2.0	1.066 ± .097	453.0 ± 24.0	.605 ± .058
55.1 ± .6	.034 ± .093	118.0 ± 2.0	1.052 ± .096	478.5 ± 26.5	.230.7 ± .058
55.7 ± .6	.010 ± .096	120.7 ± 2.0	1.034 ± .096	506.5 ± 29.4	.315 ± .026
56.3 ± .6	.001 ± .101	123.7 ± 2.0	1.067 ± .093	537.5 ± 32.7	6.315 ± .628
56.9 ± .6	.058 ± .094	126.5 ± 2.0	1.066 ± .083	572.2 ± 36.8	4.669 ± .469
57.5 ± .6	.034 ± .094	129.7 ± 2.0	1.051 ± .082	611.3 ± 41.6	.373 ± .112
58.1 ± .6	.016 ± .094	132.7 ± 2.0	1.051 ± .082	655.7 ± 47.4	.012 ± .012
58.7 ± .6	.058 ± .094	135.7 ± 2.0	1.051 ± .082		
59.3 ± .6	.034 ± .094	138.7 ± 2.0	1.051 ± .082		
59.9 ± .6	.016 ± .094	142.7 ± 2.0	1.051 ± .082		
60.5 ± .6	.058 ± .094	145.7 ± 2.0	1.051 ± .082		
61.1 ± .6	.034 ± .094	149.7 ± 2.0	1.051 ± .082		
61.7 ± .6	.016 ± .094	152.7 ± 2.0	1.051 ± .082		
62.3 ± .6	.058 ± .094	156.7 ± 2.0	1.051 ± .082		
62.9 ± .6	.034 ± .094	159.7 ± 2.0	1.051 ± .082		
63.5 ± .6	.016 ± .094	163.7 ± 2.0	1.051 ± .082		
64.1 ± .6	.058 ± .094	167.7 ± 2.0	1.051 ± .082		
64.7 ± .6	.034 ± .094	171.7 ± 2.0	1.051 ± .082		
65.3 ± .6	.016 ± .094	175.7 ± 2.0	1.051 ± .082		
65.9 ± .6	.058 ± .094	179.7 ± 2.0	1.051 ± .082		
66.5 ± .6	.034 ± .094	183.7 ± 2.0	1.051 ± .082		
67.1 ± .6	.016 ± .094	187.7 ± 2.0	1.051 ± .082		
67.7 ± .6	.058 ± .094	191.7 ± 2.0	1.051 ± .082		
68.3 ± .6	.034 ± .094	195.7 ± 2.0	1.051 ± .082		
68.9 ± .6	.016 ± .094	199.7 ± 2.0	1.051 ± .082		
69.5 ± .6	.058 ± .094	203.7 ± 2.0	1.051 ± .082		
70.1 ± .6	.034 ± .094	207.7 ± 2.0	1.051 ± .082		
70.7 ± .6	.016 ± .094	211.7 ± 2.0	1.051 ± .082		
71.3 ± .6	.058 ± .094	215.7 ± 2.0	1.051 ± .082		
71.9 ± .6	.034 ± .094	219.7 ± 2.0	1.051 ± .082		
72.5 ± .6	.016 ± .094	223.7 ± 2.0	1.051 ± .082		
73.1 ± .6	.058 ± .094	227.7 ± 2.0	1.051 ± .082		
73.7 ± .6	.034 ± .094	231.7 ± 2.0	1.051 ± .082		
74.3 ± .6	.016 ± .094	235.7 ± 2.0	1.051 ± .082		
74.9 ± .6	.058 ± .094	239.7 ± 2.0	1.051 ± .082		
75.5 ± .6	.034 ± .094	243.7 ± 2.0	1.051 ± .082		
76.1 ± .6	.016 ± .094	247.7 ± 2.0	1.051 ± .082		
76.7 ± .6	.058 ± .094	251.7 ± 2.0	1.051 ± .082		
77.3 ± .6	.034 ± .094	255.7 ± 2.0	1.051 ± .082		
77.9 ± .6	.016 ± .094	259.7 ± 2.0	1.051 ± .082		
78.5 ± .6	.058 ± .094	263.7 ± 2.0	1.051 ± .082		
79.1 ± .6	.034 ± .094	267.7 ± 2.0	1.051 ± .082		
79.7 ± .6	.016 ± .094	271.7 ± 2.0	1.051 ± .082		
80.3 ± .6	.058 ± .094	275.7 ± 2.0	1.051 ± .082		
80.9 ± .6	.034 ± .094	279.7 ± 2.0	1.051 ± .082		
81.5 ± .6	.016 ± .094	283.7 ± 2.0	1.051 ± .082		
82.1 ± .6	.058 ± .094	287.7 ± 2.0	1.051 ± .082		
82.7 ± .6	.034 ± .094	291.7 ± 2.0	1.051 ± .082		
83.3 ± .6	.016 ± .094	295.7 ± 2.0	1.051 ± .082		
83.9 ± .6	.058 ± .094	299.7 ± 2.0	1.051 ± .082		
84.5 ± .6	.034 ± .094	303.7 ± 2.0	1.051 ± .082		
85.1 ± .6	.016 ± .094	307.7 ± 2.0	1.051 ± .082		
85.7 ± .6	.058 ± .094	311.7 ± 2.0	1.051 ± .082		
86.3 ± .6	.034 ± .094	315.7 ± 2.0	1.051 ± .082		
86.9 ± .6	.016 ± .094	319.7 ± 2.0	1.051 ± .082		
87.5 ± .6	.058 ± .094	323.7 ± 2.0	1.051 ± .082		
88.1 ± .6	.034 ± .094	327.7 ± 2.0	1.051 ± .082		
88.7 ± .6	.016 ± .094	331.7 ± 2.0	1.051 ± .082		
89.3 ± .6	.058 ± .094	335.7 ± 2.0	1.051 ± .082		
89.9 ± .6	.034 ± .094	339.7 ± 2.0	1.051 ± .082		
90.5 ± .6	.016 ± .094	343.7 ± 2.0	1.051 ± .082		
91.1 ± .6	.058 ± .094	347.7 ± 2.0	1.051 ± .082		

TABLE 14.- Continued

(b) Angle of scatter of  $20^\circ$ 

Energy, MeV	Cross section, mb/sr-MeV						
48.0	1.65	120	1.076	278.9	10.3	467	.042
48.7	1.62	117	1.015	289.5	10.9	449	.041
50.3	1.62	118	1.020	300.9	11.7	442	.040
50.9	1.62	119	1.047	313.0	12.5	445	.038
51.5	1.62	120	1.093	326.0	13.3	429	.039
52.1	1.62	121	1.966	339.9	14.1	446	.041
52.7	1.62	122	1.991	354.9	15.0	478	.044
53.3	1.62	123	1.993	371.1	16.8	531	.049
53.9	1.62	124	1.986	388.6	18.2	610	.057
54.5	1.62	125	1.999	407.7	19.6	761	.061
55.1	1.62	126	1.991	428.4	21.6	936	.088
55.7	1.62	127	1.995	451.1	23.7	1.136	.114
56.3	1.62	128	1.988	476.1	26.1	1.367	.132
56.9	1.62	129	1.985	503.1	29.1	1.231	.120
57.5	1.62	130	1.990	534.2	32.3	1.808	.080
58.1	1.62	131	1.982	568.9	34.9	1.466	.054
58.7	1.62	132	1.985	606.9	40.6	1.536	.029
59.3	1.62	133	1.986	650.5	46.6	1.020	.020
59.9	1.62	134	1.983	700.4	53.6		
60.5	1.62	135	1.982				
61.1	1.62	136	1.986				
61.7	1.62	137	1.985				
62.3	1.62	138	1.986				
62.9	1.62	139	1.981				
63.5	1.62	140	1.982				
64.1	1.62	141	1.984				
64.7	1.62	142	1.985				
65.3	1.62	143	1.986				
65.9	1.62	144	1.985				
66.5	1.62	145	1.986				
67.1	1.62	146	1.981				
67.7	1.62	147	1.982				
68.3	1.62	148	1.985				
68.9	1.62	149	1.986				
69.5	1.62	150	1.984				
70.1	1.62	151	1.985				
70.7	1.62	152	1.986				
71.3	1.62	153	1.981				
71.9	1.62	154	1.982				
72.5	1.62	155	1.985				
73.1	1.62	156	1.986				
73.7	1.62	157	1.984				
74.3	1.62	158	1.985				
74.9	1.62	159	1.986				
75.5	1.62	160	1.984				
76.1	1.62	161	1.985				
76.7	1.62	162	1.986				
77.3	1.62	163	1.984				
77.9	1.62	164	1.985				
78.5	1.62	165	1.986				
79.1	1.62	166	1.984				
79.7	1.62	167	1.985				
80.3	1.62	168	1.986				
80.9	1.62	169	1.984				
81.5	1.62	170	1.985				
82.1	1.62	171	1.986				
82.7	1.62	172	1.984				
83.3	1.62	173	1.985				
83.9	1.62	174	1.986				
84.5	1.62	175	1.984				
85.1	1.62	176	1.985				
85.7	1.62	177	1.986				
86.3	1.62	178	1.984				
86.9	1.62	179	1.985				
87.5	1.62	180	1.986				
88.1	1.62	181	1.984				
88.7	1.62	182	1.985				
89.3	1.62	183	1.986				
89.9	1.62	184	1.984				
90.5	1.62	185	1.985				
91.1	1.62	186	1.986				
91.7	1.62	187	1.984				
92.3	1.62	188	1.985				
92.9	1.62	189	1.986				
93.5	1.62	190	1.984				
94.1	1.62	191	1.985				
94.7	1.62	192	1.986				
95.3	1.62	193	1.984				
95.9	1.62	194	1.985				
96.5	1.62	195	1.986				
97.1	1.62	196	1.984				
97.7	1.62	197	1.985				
98.3	1.62	198	1.986				
98.9	1.62	199	1.984				
99.5	1.62	200	1.985				
100.1	1.62	201	1.986				
100.7	1.62	202	1.984				
101.3	1.62	203	1.985				
101.9	1.62	204	1.986				
102.5	1.62	205	1.984				
103.1	1.62	206	1.985				
103.7	1.62	207	1.986				
104.3	1.62	208	1.984				
104.9	1.62	209	1.985				
105.5	1.62	210	1.986				
106.1	1.62	211	1.984				
106.7	1.62	212	1.985				
107.3	1.62	213	1.986				
107.9	1.62	214	1.984				
108.5	1.62	215	1.985				
109.1	1.62	216	1.986				
109.7	1.62	217	1.984				
110.3	1.62	218	1.985				
110.9	1.62	219	1.986				
111.5	1.62	220	1.984				
112.1	1.62	221	1.985				
112.7	1.62	222	1.986				
113.3	1.62	223	1.984				
113.9	1.62	224	1.985				
114.5	1.62	225	1.986				
115.1	1.62	226	1.984				
115.7	1.62	227	1.985				
116.3	1.62	228	1.986				
116.9	1.62	229	1.984				
117.5	1.62	230	1.985				
118.1	1.62	231	1.986				
118.7	1.62	232	1.984				
119.3	1.62	233	1.985				
119.9	1.62	234	1.986				
120.5	1.62	235	1.984				
121.1	1.62	236	1.985				
121.7	1.62	237	1.986				
122.3	1.62	238	1.984				
122.9	1.62	239	1.985				
123.5	1.62	240	1.986				
124.1	1.62	241	1.984				
124.7	1.62	242	1.985				
125.3	1.62	243	1.986				
125.9	1.62	244	1.984				
126.5	1.62	245	1.985				
127.1	1.62	246	1.986				
127.7	1.62	247	1.984				
128.3	1.62	248	1.985				
128.9	1.62	249	1.986				
129.5	1.62	250	1.984				
130.1	1.62	251	1.985				
130.7	1.62	252	1.986				
131.3	1.62	253	1.984				
131.9	1.62	254	1.985				
132.5	1.62	255	1.986				
133.1	1.62	256	1.984				
133.7	1.62	257	1.985				
134.3	1.62	258	1.986				
134.9	1.62	259	1.984				
135.5	1.62	260	1.985				
136.1	1.62	261	1.986				
136.7	1.62	262	1.984				
137.3	1.62	263	1.985				
137.9	1.62	264	1.986				
138.5	1.62	265	1.984				
139.1	1.62	266	1.985				
139.7	1.62	267	1.986				
140.3	1.62	268	1.984				
140.9	1.62	269	1.985				
141.5	1.62	270	1.986				
142.1	1.62	271	1.984				
142.7	1.62	272	1.985				
143.3	1.62	273	1.986				
143.9	1.62	274	1.984				
144.5	1.62	275	1.985				
145.1	1.62	276	1.986				
145.7	1.62	277	1.984				
146.3	1.62	278	1.985				
146.9	1.62	279	1.986				
147.5	1.62	280	1.984				
148.1	1.62	281	1.985				
148.7	1.62	282	1.986				
149.3	1.62	283	1.984				
149.9	1.62	284	1.985				
150.5	1.62	285	1.986				
151.1	1.62	286	1.984				
151.7	1.62	287	1.985				
152.3	1.62	288	1.986				
152.9	1.62	289	1.984				
153.5	1.62	290	1.985				
154.1	1.62	291	1.986				
154.7	1.62	292	1.984				
155.3	1.62	293	1.985				
155.9	1.62	294	1.986				
156.5	1.62	295	1.984				
157.1	1.62	296	1.985				
157.7	1.62	297	1.986				
158.3	1.62	298	1.984				
158.9	1.62	299	1.985				
159.5	1.62	300	1.986				
160.1	1.62	301	1.984	</td			

TABLE 14.- Continued  
(c) Angle of scatter of 30°

Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV
68.6	1.0	69.7	1.1	70.8	1.2
71.9	1.1	73.0	1.2	74.1	1.3
75.2	1.1	76.3	1.2	77.4	1.3
78.5	1.1	79.6	1.2	80.7	1.3
81.8	1.1	82.9	1.2	84.0	1.3
85.0	1.1	86.1	1.2	87.2	1.3
89.2	1.1	90.3	1.2	91.4	1.3
93.5	1.1	94.6	1.2	95.7	1.3
98.8	1.1	99.9	1.2	100.0	1.3
104.0	1.1	105.1	1.2	106.2	1.3
110.9	1.1	111.1	1.2	111.3	1.3
116.1	1.1	118.2	1.2	121.2	1.3
126.2	1.1	129.3	1.2	132.3	1.3
138.2	1.1	142.1	1.2	145.2	1.3
149.2	1.1	152.1	1.2	155.1	1.3
160.8	1.1	165.5	1.2	170.2	1.3
169.5	1.1	174.2	1.2	178.9	1.3
178.5	1.1	184.1	1.2	190.0	1.3
189.5	1.1	200.6	1.2	213.1	1.3
229.6	1.1	239.7	1.2	259.9	1.3
259.8	1.1	268.0	1.2	278.9	1.3
268.0	1.1	280.3	1.2	290.3	1.3
290.3	1.1	303.4	1.2	315.1	1.3
303.4	1.1	317.1	1.2	329.1	1.3
317.1	1.1	348.9	1.2	368.7	1.3
348.9	1.1	368.7	1.2	388.5	1.3
368.7	1.1	388.5	1.2	409.3	1.3
388.5	1.1	429.1	1.2	448.2	1.3
429.1	1.1	453.4	1.2	473.2	1.3
453.4	1.1	483.6	1.2	503.4	1.3
483.6	1.1	503.4	1.2	523.6	1.3
503.4	1.1	523.6	1.2	543.6	1.3
523.6	1.1	543.6	1.2	563.6	1.3
543.6	1.1	563.6	1.2	583.6	1.3
563.6	1.1	583.6	1.2	603.6	1.3
583.6	1.1	603.6	1.2	623.6	1.3
603.6	1.1	623.6	1.2	643.6	1.3
623.6	1.1	643.6	1.2	663.6	1.3
643.6	1.1	663.6	1.2	683.6	1.3
663.6	1.1	683.6	1.2	703.6	1.3
683.6	1.1	703.6	1.2	723.6	1.3
703.6	1.1	723.6	1.2	743.6	1.3
723.6	1.1	743.6	1.2	763.6	1.3
743.6	1.1	763.6	1.2	783.6	1.3
763.6	1.1	783.6	1.2	803.6	1.3
783.6	1.1	803.6	1.2	823.6	1.3
803.6	1.1	823.6	1.2	843.6	1.3
823.6	1.1	843.6	1.2	863.6	1.3
843.6	1.1	863.6	1.2	883.6	1.3
863.6	1.1	883.6	1.2	903.6	1.3
883.6	1.1	903.6	1.2	923.6	1.3
903.6	1.1	923.6	1.2	943.6	1.3
923.6	1.1	943.6	1.2	963.6	1.3
943.6	1.1	963.6	1.2	983.6	1.3
963.6	1.1	983.6	1.2	1003.6	1.3
983.6	1.1	1003.6	1.2	1023.6	1.3
1003.6	1.1	1023.6	1.2	1043.6	1.3
1023.6	1.1	1043.6	1.2	1063.6	1.3
1043.6	1.1	1063.6	1.2	1083.6	1.3
1063.6	1.1	1083.6	1.2	1103.6	1.3
1083.6	1.1	1103.6	1.2	1123.6	1.3
1103.6	1.1	1123.6	1.2	1143.6	1.3
1123.6	1.1	1143.6	1.2	1163.6	1.3
1143.6	1.1	1163.6	1.2	1183.6	1.3
1163.6	1.1	1183.6	1.2	1203.6	1.3
1183.6	1.1	1203.6	1.2	1223.6	1.3
1203.6	1.1	1223.6	1.2	1243.6	1.3
1223.6	1.1	1243.6	1.2	1263.6	1.3
1243.6	1.1	1263.6	1.2	1283.6	1.3
1263.6	1.1	1283.6	1.2	1303.6	1.3
1283.6	1.1	1303.6	1.2	1323.6	1.3
1303.6	1.1	1323.6	1.2	1343.6	1.3
1323.6	1.1	1343.6	1.2	1363.6	1.3
1343.6	1.1	1363.6	1.2	1383.6	1.3
1363.6	1.1	1383.6	1.2	1403.6	1.3
1383.6	1.1	1403.6	1.2	1423.6	1.3
1403.6	1.1	1423.6	1.2	1443.6	1.3
1423.6	1.1	1443.6	1.2	1463.6	1.3
1443.6	1.1	1463.6	1.2	1483.6	1.3
1463.6	1.1	1483.6	1.2	1503.6	1.3
1483.6	1.1	1503.6	1.2	1523.6	1.3
1503.6	1.1	1523.6	1.2	1543.6	1.3
1523.6	1.1	1543.6	1.2	1563.6	1.3
1543.6	1.1	1563.6	1.2	1583.6	1.3
1563.6	1.1	1583.6	1.2	1603.6	1.3
1583.6	1.1	1603.6	1.2	1623.6	1.3
1603.6	1.1	1623.6	1.2	1643.6	1.3
1623.6	1.1	1643.6	1.2	1663.6	1.3
1643.6	1.1	1663.6	1.2	1683.6	1.3
1663.6	1.1	1683.6	1.2	1703.6	1.3
1683.6	1.1	1703.6	1.2	1723.6	1.3
1703.6	1.1	1723.6	1.2	1743.6	1.3
1723.6	1.1	1743.6	1.2	1763.6	1.3
1743.6	1.1	1763.6	1.2	1783.6	1.3
1763.6	1.1	1783.6	1.2	1803.6	1.3
1783.6	1.1	1803.6	1.2	1823.6	1.3
1803.6	1.1	1823.6	1.2	1843.6	1.3
1823.6	1.1	1843.6	1.2	1863.6	1.3
1843.6	1.1	1863.6	1.2	1883.6	1.3
1863.6	1.1	1883.6	1.2	1903.6	1.3
1883.6	1.1	1903.6	1.2	1923.6	1.3
1903.6	1.1	1923.6	1.2	1943.6	1.3
1923.6	1.1	1943.6	1.2	1963.6	1.3
1943.6	1.1	1963.6	1.2	1983.6	1.3
1963.6	1.1	1983.6	1.2	2003.6	1.3
1983.6	1.1	2003.6	1.2	2023.6	1.3
2003.6	1.1	2023.6	1.2	2043.6	1.3
2023.6	1.1	2043.6	1.2	2063.6	1.3
2043.6	1.1	2063.6	1.2	2083.6	1.3
2063.6	1.1	2083.6	1.2	2103.6	1.3
2083.6	1.1	2103.6	1.2	2123.6	1.3
2103.6	1.1	2123.6	1.2	2143.6	1.3
2123.6	1.1	2143.6	1.2	2163.6	1.3
2143.6	1.1	2163.6	1.2	2183.6	1.3
2163.6	1.1	2183.6	1.2	2203.6	1.3
2183.6	1.1	2203.6	1.2	2223.6	1.3
2203.6	1.1	2223.6	1.2	2243.6	1.3
2223.6	1.1	2243.6	1.2	2263.6	1.3
2243.6	1.1	2263.6	1.2	2283.6	1.3
2263.6	1.1	2283.6	1.2	2303.6	1.3
2283.6	1.1	2303.6	1.2	2323.6	1.3
2303.6	1.1	2323.6	1.2	2343.6	1.3
2323.6	1.1	2343.6	1.2	2363.6	1.3
2343.6	1.1	2363.6	1.2	2383.6	1.3
2363.6	1.1	2383.6	1.2	2403.6	1.3
2383.6	1.1	2403.6	1.2	2423.6	1.3
2403.6	1.1	2423.6	1.2	2443.6	1.3
2423.6	1.1	2443.6	1.2	2463.6	1.3
2443.6	1.1	2463.6	1.2	2483.6	1.3
2463.6	1.1	2483.6	1.2	2503.6	1.3
2483.6	1.1	2503.6	1.2	2523.6	1.3
2503.6	1.1	2523.6	1.2	2543.6	1.3
2523.6	1.1	2543.6	1.2	2563.6	1.3
2543.6	1.1	2563.6	1.2	2583.6	1.3
2563.6	1.1	2583.6	1.2	2603.6	1.3
2583.6	1.1	2603.6	1.2	2623.6	1.3
2603.6	1.1	2623.6	1.2	2643.6	1.3
2623.6	1.1	2643.6	1.2	2663.6	1.3
2643.6	1.1	2663.6	1.2	2683.6	1.3
2663.6	1.1	2683.6	1.2	2703.6	1.3
2683.6	1.1	2703.6	1.2	2723.6	1.3
2703.6	1.1	2723.6	1.2	2743.6	1.3
2723.6	1.1	2743.6	1.2	2763.6	1.3
2743.6	1.1	2763.6	1.2	2783.6	1.3
2763.6	1.1	2783.6	1.2	2803.6	1.3
2783.6	1.1	2803.6	1.2	2823.6	1.3
2803.6	1.1	2823.6	1.2	2843.6	1.3
2823.6	1.1	2843.6	1.2	2863.6	1.3
2843.6	1.1	2863.6	1.2	2883.6	1.3
2863.6	1.1	2883.6	1.2	2903.6	1.3
2883.6	1.1	2903.6	1.2	2923.6	1.3
2903.6	1.1	2923.6	1.2	2943.6	1.3
2923.6	1.1	2943.6	1.2	2963.6	1.3
2943.6	1.1	2963.6	1.2	2983.6	1.3
2963.6	1.1	2983.6	1.2	3003.6	1.3
2983.6	1.1	3003.6	1.2	3023.6	1.3
3003.6	1.1	3023.6	1.2	3043.6	1.3
3023.6	1.1	3043.6	1.2	3063.6	1.3
3043.6	1.1	3063.6	1.2	3083.6	1.3
3063.6	1.1	3083.6	1.2	3103.6	1.3
3083.6	1.1	3103.6	1.2	3123.6	1.3
3103.6	1.1	3123.6	1.2	3143.6	1.3
3123.6	1.1	3143.6	1.2	3163.6	1.3
3143.6	1.1	3163.6	1.2	3183.6	1.3
3163.6	1.1	3183.6	1.2	3203.6	1.3
3183.6	1.1	3203.6	1.2	3223.6	1.3
3203.6	1.1	3223.6	1.2	3243.6	1.3
3223.6	1.1	3243.6	1.2	3263.6	1.3
3243.6	1.1	3263.6	1.2	3283.6	1.3
3263.6	1.1	3283.6	1.2	3303.6	1.3
3283.6	1.1	3303.6	1.2	3323.6	1.3
3303.6	1.1	3323.6	1.2	3343.6	1.3
3323.6	1.1	3343.6	1.2	3363.6	1.3
3343.6	1.1	3363.6	1.2	3383.6	1.3
3363.6	1.1	3383.6	1.2	3403.6	1.3
3383.6	1.1	3403.6	1.2	3423.6	1.3
3403.6	1.1	3423.6	1.2	3443.6	1.3
3423.6	1.1	3443.6	1.2	3463.6	1.3
3443.6	1.1	3463.6	1.2	3483.6	1.3
3463.6	1.1	3483.6	1.2	3503.6	1.3
3483.6	1.1	3503.6	1.2	3523.6	1.3
3503.6	1.1	3523.6	1.2	3543.6	1.3
3523.6	1.1	3543.6	1.2</		

TABLE 14.- Continued

(d) Angle of scatter of  $40^\circ$ 

Energy, MeV	Cross section, mb/sr-MeV						
48.4	748	137	868	.071	283.6	10.5	.039
49.5	496	1118	.070	294.2	.038	429	
50.5	393	1112	.071	306.4	.035	414	
51.5	267	1106	.073	318.6	.035	386	
52.5	149	1101	.097	320.8	.032	360	
53.5	120	1107	.097	322.9	.029	323	
54.5	104	1102	.092	324.1	.026	282	
55.5	82	1114	.088	325.3	.021	232	
56.5	63	1113	.082	326.5	.017	181	
57.5	53	1117	.074	327.7	.012	134	
58.5	43	1119	.074	328.9	.008	93	
59.5	34	1120	.071	330.1	.005	59	
60.5	26	1116	.071	331.3	.002	27	
61.5	18	1117	.071	332.5	.001	10	
62.5	11	1120	.070	333.7	.001	4	
63.5	7	1114	.069	334.9	.001	0	
64.5	5	1119	.069	336.1	.000	0	
65.5	3	1120	.069	337.3	.000	0	
66.5	2	1116	.069	338.5	.000	0	
67.5	1	1117	.069	339.7	.000	0	
68.5		1120	.069	340.9	.000	0	
69.5		1114	.069	342.1	.000	0	
70.5		1119	.069	343.3	.000	0	
71.5		1120	.069	344.5	.000	0	
72.5		1116	.069	345.7	.000	0	
73.5		1117	.069	346.9	.000	0	
74.5		1120	.069	348.1	.000	0	
75.5		1114	.069	349.3	.000	0	
76.5		1119	.069	350.5	.000	0	
77.5		1120	.069	351.7	.000	0	
78.5		1116	.069	352.9	.000	0	
79.5		1117	.069	354.1	.000	0	
80.5		1120	.069	355.3	.000	0	
81.5		1114	.069	356.5	.000	0	
82.5		1119	.069	357.7	.000	0	
83.5		1120	.069	358.9	.000	0	
84.5		1116	.069	359.1	.000	0	
85.5		1117	.069	360.3	.000	0	
86.5		1120	.069	361.5	.000	0	
87.5		1114	.069	362.7	.000	0	
88.5		1119	.069	363.9	.000	0	
89.5		1120	.069	365.1	.000	0	
90.5		1116	.069	366.3	.000	0	
91.5		1117	.069	367.5	.000	0	
92.5		1120	.069	368.7	.000	0	
93.5		1114	.069	369.9	.000	0	
94.5		1119	.069	371.1	.000	0	
95.5		1120	.069	372.3	.000	0	
96.5		1116	.069	373.5	.000	0	
97.5		1117	.069	374.7	.000	0	
98.5		1120	.069	375.9	.000	0	
99.5		1114	.069	377.1	.000	0	
100.5		1119	.069	378.3	.000	0	
101.5		1120	.069	379.5	.000	0	
102.5		1116	.069	380.7	.000	0	
103.5		1117	.069	381.9	.000	0	
104.5		1120	.069	383.1	.000	0	
105.5		1114	.069	384.3	.000	0	
106.5		1119	.069	385.5	.000	0	
107.5		1120	.069	386.7	.000	0	
108.5		1116	.069	387.9	.000	0	
109.5		1117	.069	389.1	.000	0	
110.5		1120	.069	390.3	.000	0	
111.5		1114	.069	391.5	.000	0	
112.5		1119	.069	392.7	.000	0	
113.5		1120	.069	393.9	.000	0	
114.5		1116	.069	395.1	.000	0	
115.5		1117	.069	396.3	.000	0	
116.5		1120	.069	397.5	.000	0	
117.5		1114	.069	398.7	.000	0	
118.5		1119	.069	399.9	.000	0	
119.5		1120	.069	401.1	.000	0	
120.5		1116	.069	402.3	.000	0	
121.5		1117	.069	403.5	.000	0	
122.5		1120	.069	404.7	.000	0	
123.5		1114	.069	405.9	.000	0	
124.5		1119	.069	407.1	.000	0	
125.5		1120	.069	408.3	.000	0	
126.5		1116	.069	409.5	.000	0	
127.5		1117	.069	410.7	.000	0	
128.5		1120	.069	411.9	.000	0	
129.5		1114	.069	413.1	.000	0	
130.5		1119	.069	414.3	.000	0	
131.5		1120	.069	415.5	.000	0	
132.5		1116	.069	416.7	.000	0	
133.5		1117	.069	417.9	.000	0	
134.5		1120	.069	419.1	.000	0	
135.5		1114	.069	420.3	.000	0	
136.5		1119	.069	421.5	.000	0	
137.5		1120	.069	422.7	.000	0	
138.5		1116	.069	423.9	.000	0	
139.5		1117	.069	425.1	.000	0	
140.5		1120	.069	426.3	.000	0	
141.5		1114	.069	427.5	.000	0	
142.5		1119	.069	428.7	.000	0	
143.5		1120	.069	429.9	.000	0	
144.5		1116	.069	431.1	.000	0	
145.5		1117	.069	432.3	.000	0	
146.5		1120	.069	433.5	.000	0	
147.5		1114	.069	434.7	.000	0	
148.5		1119	.069	435.9	.000	0	
149.5		1120	.069	437.1	.000	0	
150.5		1116	.069	438.3	.000	0	
151.5		1117	.069	439.5	.000	0	
152.5		1120	.069	440.7	.000	0	
153.5		1114	.069	441.9	.000	0	
154.5		1119	.069	443.1	.000	0	
155.5		1120	.069	444.3	.000	0	
156.5		1116	.069	445.5	.000	0	
157.5		1117	.069	446.7	.000	0	
158.5		1120	.069	447.9	.000	0	
159.5		1114	.069	449.1	.000	0	
160.5		1119	.069	450.3	.000	0	
161.5		1120	.069	451.5	.000	0	
162.5		1116	.069	452.7	.000	0	
163.5		1117	.069	453.9	.000	0	
164.5		1120	.069	455.1	.000	0	
165.5		1114	.069	456.3	.000	0	
166.5		1119	.069	457.5	.000	0	
167.5		1120	.069	458.7	.000	0	
168.5		1116	.069	459.9	.000	0	
169.5		1117	.069	461.1	.000	0	
170.5		1120	.069	462.3	.000	0	
171.5		1114	.069	463.5	.000	0	
172.5		1119	.069	464.7	.000	0	
173.5		1120	.069	465.9	.000	0	
174.5		1116	.069	467.1	.000	0	
175.5		1117	.069	468.3	.000	0	
176.5		1120	.069	469.5	.000	0	
177.5		1114	.069	470.7	.000	0	
178.5		1119	.069	471.9	.000	0	
179.5		1120	.069	473.1	.000	0	
180.5		1116	.069	474.3	.000	0	
181.5		1117	.069	475.5	.000	0	
182.5		1120	.069	476.7	.000	0	
183.5		1114	.069	477.9	.000	0	
184.5		1119	.069	479.1	.000	0	
185.5		1120	.069	480.3	.000	0	
186.5		1116	.069	481.5	.000	0	
187.5		1117	.069	482.7	.000	0	
188.5		1120	.069	483.9	.000	0	
189.5		1114	.069	485.1	.000	0	
190.5		1119	.069	486.3	.000	0	
191.5		1120	.069	487.5	.000	0	
192.5		1116	.069	488.7	.000	0	
193.5		1117	.069	489.9	.000	0	
194.5		1120	.069	491.1	.000	0	
195.5		1114	.069	492.3	.000	0	
196.5		1119	.069	493.5	.000	0	
197.5		1120	.069	494.7	.000	0	
198.5		1116	.069	495.9	.000	0	
199.5		1117	.069	497.1	.000	0	
200.5		1120	.069	498.3	.000	0	
201.5		1114	.069	499.5	.000	0	
202.5		1119	.069	500.7	.000	0	
203.5		1120	.069	501.9	.000	0	
204.5		1116	.069	503.1	.000	0	
205.5		1117	.069	504.3	.000	0	
206.5		1120	.069	505.5	.000	0	
207.5		1114	.069	506.7	.000	0	
208.5		1119	.069	507.9	.000	0	
209.5		1120	.069	509.1	.000	0	
210.5		1116	.069	510.3	.000	0	
211.5		1117	.069	511.5	.000	0	
212.5		1120	.069	512.7	.000	0	
213.5		1114	.069	513.9	.000	0	
214.5		1119	.069	515.1	.000	0	
215.5		1120	.069	516.3	.000	0	
216.5		1116	.069	517.5	.000	0	
217.5		1117	.069	518.7	.000	0	
218.5		1120	.069	519.9	.000	0	
219.5		1114	.069	521.1	.000	0	

TABLE 14.- Continued

(e) Angle of scatter of 50°

Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV
48.0	.000	49.0	.000	50.0	.000
49.5	.620	50.5	.128	51.5	.109
50.0	.356	51.0	.111	52.0	.102
50.5	.315	51.5	.107	52.5	.097
51.0	.222	52.0	.097	53.0	.097
51.5	.155	52.5	.091	53.5	.093
52.0	.111	53.0	.093	54.0	.094
52.5	.091	53.5	.094	54.5	.094
53.0	.066	54.0	.086	55.0	.086
53.5	.066	54.5	.086	56.0	.086
54.0	.091	55.0	.086	57.0	.086
54.5	.091	56.0	.086	58.0	.086
55.0	.091	57.0	.086	59.0	.086
56.0	.091	58.0	.086	60.0	.086
57.0	.091	59.0	.086	61.0	.086
58.0	.091	60.0	.086	62.0	.086
59.0	.091	61.0	.086	63.0	.086
60.0	.091	62.0	.086	64.0	.086
61.0	.091	63.0	.086	65.0	.086
62.0	.091	64.0	.086	66.0	.086
63.0	.091	65.0	.086	67.0	.086
64.0	.091	66.0	.086	68.0	.086
65.0	.091	67.0	.086	69.0	.086
66.0	.091	68.0	.086	70.0	.086
67.0	.091	69.0	.086	71.0	.086
68.0	.091	70.0	.086	72.0	.086
69.0	.091	71.0	.086	73.0	.086
70.0	.091	72.0	.086	74.0	.086
71.0	.091	73.0	.086	75.0	.086
72.0	.091	74.0	.086	76.0	.086
73.0	.091	75.0	.086	77.0	.086
74.0	.091	76.0	.086	78.0	.086
75.0	.091	77.0	.086	79.0	.086
76.0	.091	78.0	.086	80.0	.086
77.0	.091	79.0	.086	81.0	.086
78.0	.091	80.0	.086	82.0	.086
79.0	.091	81.0	.086	83.0	.086
80.0	.091	82.0	.086	84.0	.086
81.0	.091	83.0	.086	85.0	.086
82.0	.091	84.0	.086	86.0	.086
83.0	.091	85.0	.086	87.0	.086
84.0	.091	86.0	.086	88.0	.086
85.0	.091	87.0	.086	89.0	.086
86.0	.091	88.0	.086	90.0	.086
87.0	.091	89.0	.086		

TABLE 14.- Concluded

(f) Angle of scatter of  $60^\circ$ 

Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV
48.0	.000	1.1	.000	1.7	.000
49.5	.361	1.2	.108	2.3	.005
50.0	.210	1.3	.097	2.5	.005
50.5	.044	1.4	.086	2.7	.005
51.0	.977	1.5	.083	2.9	.005
51.5	.978	1.6	.082	3.1	.005
52.0	.929	1.7	.081	3.3	.005
52.5	.953	1.8	.079	3.5	.005
53.0	.907	1.9	.082	3.7	.005
53.5	.853	2.0	.078	3.9	.005
54.0	.865	2.1	.074	4.1	.005
54.5	.835	2.2	.074	4.3	.005
55.0	.906	2.3	.072	4.5	.005
55.5	.750	2.4	.079	4.7	.005
56.0	.849	2.5	.075	4.9	.005
56.5	.842	2.6	.075	5.1	.005
57.0	.827	2.7	.074	5.3	.005
57.5	.860	2.8	.074	5.5	.005
58.0	.852	2.9	.075	5.7	.005
58.5	.839	3.0	.073	5.9	.005
59.0	.829	3.1	.073	6.1	.005
59.5	.814	3.2	.072	6.3	.005
60.0	.809	3.3	.072	6.5	.005
60.5	.800	3.4	.074	6.7	.005
61.0	.820	3.5	.074	6.9	.005
61.5	.835	3.6	.075	7.1	.005
62.0	.813	3.7	.073	7.3	.005
62.5	.806	3.8	.074	7.5	.005
63.0	.786	3.9	.070	7.7	.005
63.5	.792	4.0	.072	7.9	.005
64.0	.771	4.1	.069	8.1	.005
64.5	.754	4.2	.068	8.3	.005
65.0	.758	4.3	.068	8.5	.005
65.5	.702	4.4	.063	8.7	.005
66.0	.732	4.5	.063	8.9	.005
66.5	.769	4.6	.063	9.1	.005
67.0	.708	4.7	.064	9.3	.005
67.5	.723	4.8	.064	9.5	.005
68.0	.720	4.9	.064	9.7	.005

TABLE 15.- DOUBLE DIFFERENTIAL CROSS SECTIONS FOR PRODUCTION OF  
SECONDARY PROTONS FROM GERMANIUM TARGET, 5.26 g/cm<sup>2</sup> THICK

[Incident proton energy, 558 MeV]

(a) Angle of scatter of 10°

Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV
47.9 ± .6	.000 ± .000	93.1 ± 1.7	1.056 ± .094	279.5 ± 10.3	.646 ± .058
48.5 ± .6	1.603 ± .127	94.9 ± 1.7	1.004 ± .089	290.2 ± 11.0	.617 ± .056
49.2 ± .6	1.494 ± .120	96.7 ± 1.8	1.006 ± .089	301.6 ± 11.8	.631 ± .053
49.6 ± .6	1.444 ± .119	98.6 ± 1.9	1.006 ± .089	313.8 ± 12.6	.595 ± .054
50.5 ± .6	1.543 ± .129	100.5 ± 1.9	.956 ± .084	326.9 ± 13.5	.521 ± .051
51.2 ± .6	1.402 ± .118	102.5 ± 2.0	1.010 ± .089	340.9 ± 14.5	.521 ± .048
51.9 ± .7	1.247 ± .105	104.6 ± 2.1	.972 ± .086	356.1 ± 15.7	.504 ± .046
52.3 ± .7	1.373 ± .117	106.7 ± 2.2	1.005 ± .089	372.4 ± 16.9	.488 ± .045
53.0 ± .7	1.366 ± .117	108.9 ± 2.3	1.033 ± .092	390.1 ± 18.4	.515 ± .051
54.0 ± .7	1.214 ± .104	111.2 ± 2.3	.956 ± .086	409.3 ± 20.0	.584 ± .055
55.0 ± .7	1.160 ± .100	113.5 ± 2.3	1.041 ± .092	430.3 ± 21.9	.519 ± .049
55.6 ± .7	1.288 ± .111	115.9 ± 2.4	.968 ± .085	453.3 ± 24.0	.561 ± .054
55.7 ± .7	1.190 ± .103	118.4 ± 2.5	.973 ± .085	478.5 ± 26.5	.529 ± .050
56.3 ± .7	1.280 ± .111	121.0 ± 2.6	.929 ± .085	506.5 ± 29.4	.537 ± .051
57.2 ± .8	1.214 ± .107	123.7 ± 2.7	.942 ± .082	537.5 ± 32.7	.572 ± .055
58.0 ± .8	1.271 ± .112	126.5 ± 2.8	.872 ± .076	572.2 ± 36.8	.611 ± .059
58.8 ± .8	1.167 ± .104	129.4 ± 2.9	.953 ± .080	655.7 ± 47.4	.396 ± .041
59.7 ± .7	1.137 ± .101	132.3 ± 3.0	.911 ± .070	665.7 ± 47.4	.105 ± .011
60.6 ± .7	1.066 ± .095	135.4 ± 3.1	.897 ± .077		
61.5 ± .7	1.222 ± .108	138.7 ± 3.2	.926 ± .076		
62.3 ± .7	1.154 ± .102	142.0 ± 3.4	.918 ± .078		
63.3 ± .7	1.026 ± .091	145.5 ± 3.5	.947 ± .080		
65.3 ± .7	1.114 ± .099	149.1 ± 3.6	.950 ± .081		
66.3 ± .7	1.054 ± .094	152.8 ± 3.7	.939 ± .080		
67.3 ± .7	1.262 ± .113	156.7 ± 3.8	.870 ± .074		
68.3 ± .7	1.099 ± .099	160.8 ± 3.9	.899 ± .077		
69.5 ± .7	1.142 ± .103	165.1 ± 4.0	.890 ± .076		
70.6 ± .7	1.128 ± 1.02	169.1 ± 4.1	.879 ± .075		
71.8 ± .7	1.137 ± 1.02	174.1 ± 4.2	.875 ± .075		
72.9 ± .7	1.115 ± 1.00	179.0 ± 4.3	.822 ± .071		
74.1 ± .7	1.072 ± .095	184.0 ± 4.4	.770 ± .066		
75.4 ± .7	1.098 ± .098	189.3 ± 4.5	.870 ± .077		
76.6 ± .7	1.140 ± .102	194.9 ± 4.6	.915 ± .081		
77.9 ± .7	1.068 ± .096	200.7 ± 4.7	.842 ± .075		
79.3 ± .7	1.089 ± .098	206.8 ± 4.8	.772 ± .069		
80.7 ± .7	1.013 ± .091	213.2 ± 4.9	.786 ± .070		
82.1 ± .7	1.015 ± .091	220.0 ± 5.0	.801 ± .071		
83.5 ± .7	1.067 ± .087	227.1 ± 5.1	.792 ± .070		
85.0 ± .7	.989 ± .089	234.7 ± 5.2	.766 ± .068		
86.5 ± .7	1.085 ± .097	242.6 ± 5.3	.734 ± .068		
88.1 ± .7	1.118 ± .100	251.0 ± 5.4	.700 ± .066		
89.7 ± .7	1.034 ± .092	259.9 ± 5.5	.658 ± .059		
91.4 ± .7	1.017 ± .091	269.4 ± 5.6			

TABLE 15.- Continued  
(b) Angle of scatter of 20°

Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV
.6	.000	93.3	1.011	278.9	.442
.6	.142	95.0	.987	289.5	.418
.6	.124	96.9	.946	300.9	.410
.6	.127	98.7	.933	313.0	.395
.6	.110	100.7	.922	326.0	.403
.6	.110	102.7	.935	339.9	.416
.6	.108	104.7	.928	354.9	.436
.6	.109	106.8	.898	371.1	.488
.6	.111	109.0	.877	388.6	.569
.6	.105	111.3	.933	407.7	.703
.6	.113	113.6	.867	428.4	.897
.6	.110	116.6	.890	451.1	.109
.6	.111	118.6	.862	476.1	.121
.6	.100	121.1	.859	503.6	.113
.6	.100	123.8	.808	534.2	.108
.6	.105	126.1	.826	568.4	.738
.6	.108	129.5	.797	606.9	.246
.6	.103	132.5	.784	650.5	.046
.6	.104	135.7	.763	700.4	.53.6
.6	.102	138.7	.799		
.6	.103	142.1	.786		
.6	.105	145.4	.758		
.6	.106	149.7	.749		
.6	.107	152.9	.716		
.6	.101	156.8	.718		
.6	.101	160.1	.692		
.6	.098	165.7	.703		
.6	.098	169.7	.652		
.6	.098	174.9	.637		
.6	.098	184.0	.632		
.6	.097	189.2	.609		
.6	.097	194.8	.641		
.6	.097	200.6	.632		
.6	.097	206.7	.588		
.6	.097	213.1	.576		
.6	.097	219.8	.561		
.6	.097	226.9	.538		
.6	.097	234.7	.513		
.6	.097	242.3	.487		
.6	.097	250.6	.480		
.6	.097	259.5	.446		
.6	.097	268.9	.040		
48.0	.000	93.3	1.011	.090	.040
48.0	.142	95.0	.987	.088	.038
49.3	.124	96.9	.946	.084	.037
49.3	.127	98.7	.933	.083	.036
50.0	.110	100.7	.922	.081	.037
50.0	.110	102.7	.935	.081	.037
50.0	.108	104.7	.928	.082	.038
50.0	.109	106.8	.898	.079	.040
50.0	.111	109.0	.877	.078	.045
50.0	.105	111.3	.933	.083	.053
50.0	.113	113.6	.867	.077	.066
50.0	.110	116.6	.890	.078	.084
50.0	.111	118.6	.862	.075	.104
50.0	.100	121.1	.859	.075	.121
50.0	.100	123.8	.808	.070	.125
50.0	.105	126.1	.826	.072	.127
50.0	.108	129.5	.797	.067	.129
50.0	.103	132.5	.784	.066	.131
50.0	.104	135.7	.763	.064	.133
50.0	.102	138.7	.799	.067	.135
50.0	.103	142.1	.786	.066	.137
50.0	.105	145.4	.758	.064	.139
50.0	.106	149.7	.749	.063	.141
50.0	.107	152.9	.716	.061	.143
50.0	.101	156.8	.718	.061	.145
50.0	.101	160.1	.692	.060	.147
50.0	.098	165.7	.703	.059	.149
50.0	.098	169.7	.652	.058	.151
50.0	.098	174.9	.637	.057	.153
50.0	.098	184.0	.632	.054	.155
50.0	.097	189.2	.609	.054	.157
50.0	.097	194.8	.641	.057	.159
50.0	.097	200.6	.632	.056	.161
50.0	.097	206.7	.588	.052	.163
50.0	.097	213.1	.576	.051	.165
50.0	.097	219.8	.561	.050	.167
50.0	.097	226.9	.538	.048	.169
50.0	.097	234.7	.513	.046	.171
50.0	.097	242.3	.487	.043	.173
50.0	.097	250.6	.480	.043	.175
50.0	.097	259.5	.446	.040	.177
51.3	.124	96.9	.946	.084	.037
51.3	.127	98.7	.933	.083	.036
51.3	.110	100.7	.922	.081	.037
51.3	.110	102.7	.935	.081	.037
51.3	.108	104.7	.928	.082	.038
51.3	.109	106.8	.898	.079	.040
51.3	.111	109.0	.877	.078	.045
51.3	.105	111.3	.933	.083	.053
51.3	.113	113.6	.867	.077	.066
51.3	.110	116.6	.890	.078	.084
51.3	.111	118.6	.862	.075	.104
51.3	.100	121.1	.859	.075	.121
51.3	.100	123.8	.808	.070	.125
51.3	.105	126.1	.826	.072	.127
51.3	.108	129.5	.797	.067	.129
51.3	.103	132.5	.784	.066	.131
51.3	.104	135.7	.763	.064	.133
51.3	.102	138.7	.799	.067	.135
51.3	.103	142.1	.786	.066	.137
51.3	.105	145.4	.758	.064	.139
51.3	.106	149.7	.749	.063	.141
51.3	.107	152.9	.716	.061	.143
51.3	.101	156.8	.718	.061	.145
51.3	.101	160.1	.692	.060	.147
51.3	.098	165.7	.703	.059	.149
51.3	.098	169.7	.652	.058	.151
51.3	.098	174.9	.637	.057	.153
51.3	.098	184.0	.632	.054	.155
51.3	.097	189.2	.609	.054	.157
51.3	.097	194.8	.641	.057	.159
51.3	.097	200.6	.632	.056	.161
51.3	.097	206.7	.588	.052	.163
51.3	.097	213.1	.576	.051	.165
51.3	.097	219.8	.561	.050	.167
51.3	.097	226.9	.538	.048	.169
51.3	.097	234.7	.513	.046	.171
51.3	.097	242.3	.487	.043	.173
51.3	.097	250.6	.480	.043	.175
51.3	.097	259.5	.446	.040	.177
52.6	.124	96.9	.946	.084	.037
52.6	.127	98.7	.933	.083	.036
52.6	.110	100.7	.922	.081	.037
52.6	.110	102.7	.935	.081	.037
52.6	.108	104.7	.928	.082	.038
52.6	.109	106.8	.898	.079	.040
52.6	.111	109.0	.877	.078	.045
52.6	.105	111.3	.933	.083	.053
52.6	.113	113.6	.867	.077	.066
52.6	.110	116.6	.890	.078	.084
52.6	.111	118.6	.862	.075	.104
52.6	.100	121.1	.859	.075	.121
52.6	.100	123.8	.808	.070	.125
52.6	.105	126.1	.826	.072	.127
52.6	.108	129.5	.797	.067	.129
52.6	.103	132.5	.784	.066	.131
52.6	.104	135.7	.763	.064	.133
52.6	.102	138.7	.799	.067	.135
52.6	.103	142.1	.786	.066	.137
52.6	.105	145.4	.758	.064	.139
52.6	.106	149.7	.749	.063	.141
52.6	.107	152.9	.716	.061	.143
52.6	.101	156.8	.718	.061	.145
52.6	.101	160.1	.692	.060	.147
52.6	.098	165.7	.703	.059	.149
52.6	.098	169.7	.652	.058	.151
52.6	.098	174.9	.637	.057	.153
52.6	.098	184.0	.632	.054	.155
52.6	.097	189.2	.609	.054	.157
52.6	.097	194.8	.641	.057	.159
52.6	.097	200.6	.632	.056	.161
52.6	.097	206.7	.588	.052	.163
52.6	.097	213.1	.576	.051	.165
52.6	.097	219.8	.561	.050	.167
52.6	.097	226.9	.538	.048	.169
52.6	.097	234.7	.513	.046	.171
52.6	.097	242.3	.487	.043	.173
52.6	.097	250.6	.480	.043	.175
52.6	.097	259.5	.446	.040	.177
53.9	.124	96.9	.946	.084	.037
53.9	.127	98.7	.933	.083	.036
53.9	.110	100.7	.922	.081	.037
53.9	.110	102.7	.935	.081	.037
53.9	.108	104.7	.928	.082	.038
53.9	.109	106.8	.898	.079	.040
53.9	.111	109.0	.877	.078	.045
53.9	.105	111.3	.933	.083	.053
53.9	.113	113.6	.867	.077	.066
53.9	.110	116.6	.890	.078	.084
53.9	.111	118.6	.862	.075	.104
53.9	.100	121.1	.859	.075	.121
53.9	.100	123.8	.808	.070	.125
53.9	.105	126.1	.826	.072	.127
53.9	.108	129.5	.797	.067	.129
53.9	.103	132.5	.784	.066	.131
53.9	.104	135.7	.763	.064	.133
53.9	.102	138.7	.799	.067	.135
53.9	.103	142.1	.786	.066	.137
53.9	.105	145.4	.758	.064	.139
53.9	.106	149.7	.749	.063	.141
53.9	.107	152.9	.716	.061	.143
53.9	.101	156.8	.718	.061	.145
53.9	.101	160.1	.692	.060	.147
53.9	.098	165.7	.703	.059	.149
53.9	.098	169.7	.652	.058	.151
53.9	.098	174.9	.637	.057	.153
53.9	.098	184.0	.632	.054	.155
53.9	.097	189.2	.609	.054	.157
53.9	.097	194.8	.641	.057	.159
53.9	.097	200.6	.632	.056	.161
53.9	.097	206.7	.588	.052	.163
53.9	.097	213.1	.576	.051	.165
53.9	.097	219.8	.561	.050	.167
53.9	.097	226.9	.538	.048	.169
53.9	.097	234.7	.513	.046	.171
53.9	.097	242.3	.487	.043	.173
53.9	.097	250.6	.480	.043	.175
53.9	.097	259.5	.446	.040	.177
55.2	.124	96.9	.946	.084	.037
55.2	.127	98.7	.933	.083	.036
55.2	.110	100.7	.922	.081	.037
55.2	.110	102.7	.935	.081	.037
55.2					

TABLE 15.- Continued  
(c) Angle of scatter of  $30^\circ$

Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV
48.0	.000	93.3	.1.7	278.9	.3
48.7	.000	95.0	.1.7	289.5	.3
49.3	.000	96.9	.1.8	290.9	.7
50.0	.000	98.7	.1.9	300.9	.7
50.6	.000	100.7	.2.0	313.0	.5
51.3	.000	102.7	.2.2	326.0	.4
52.0	.000	104.7	.2.4	339.9	.4
52.7	.000	106.8	.2.5	354.9	.5
53.4	.000	109.0	.2.6	371.1	.6
54.1	.000	111.3	.2.7	388.6	.8
54.8	.000	113.6	.2.8	407.7	.9
55.5	.000	116.1	.2.9	428.4	.7
56.2	.000	118.6	.3.0	451.1	.7
56.9	.000	121.1	.3.1	476.1	.2
57.6	.000	123.8	.3.2	503.6	.2
58.3	.000	126.5	.3.3	534.2	.3
59.0	.000	129.2	.3.4	568.4	.2
59.7	.000	132.5	.3.5	606.9	.9
60.4	.000	135.7	.3.6	650.5	.6
61.1	.000	138.0	.3.7	700.4	.6
61.8	.000	142.1	.3.8		
62.5	.000	145.5	.3.9		
63.2	.000	152.9	.4.0		
63.9	.000	156.8	.4.1		
64.6	.000	160.1	.4.2		
65.3	.000	169.5	.4.3		
66.0	.000	178.9	.4.4		
66.7	.000	184.0	.4.5		
67.4	.000	189.4	.4.6		
68.1	.000	194.6	.4.7		
68.8	.000	200.6	.4.8		
69.5	.000	213.1	.4.9		
70.2	.000	219.9	.5.0		
70.9	.000	226.4	.5.1		
71.6	.000	234.2	.5.2		
72.3	.000	242.5	.5.3		
73.0	.000	250.5	.5.4		
73.7	.000	259.5	.5.5		
74.4	.000	268.5	.5.6		
75.1	.000				
75.8	.000				
76.5	.000				
77.2	.000				
77.9	.000				
78.6	.000				
79.3	.000				
80.0	.000				
80.7	.000				
81.4	.000				
82.1	.000				
82.8	.000				
83.5	.000				
84.2	.000				
84.9	.000				
85.6	.000				
86.3	.000				
87.0	.000				
87.7	.000				
88.4	.000				
89.1	.000				
89.8	.000				
90.5	.000				
91.2	.000				
91.9	.000				
92.6	.000				
93.3	.000				
94.0	.000				
94.7	.000				
95.4	.000				
96.1	.000				
96.8	.000				
97.5	.000				
98.2	.000				
98.9	.000				
99.6	.000				
100.3	.000				
101.0	.000				
101.7	.000				
102.4	.000				
103.1	.000				
103.8	.000				
104.5	.000				
105.2	.000				
105.9	.000				
106.6	.000				
107.3	.000				
108.0	.000				
108.7	.000				
109.4	.000				
110.1	.000				
110.8	.000				
111.5	.000				
112.2	.000				
112.9	.000				
113.6	.000				
114.3	.000				
115.0	.000				
115.7	.000				
116.4	.000				
117.1	.000				
117.8	.000				
118.5	.000				
119.2	.000				
119.9	.000				
120.6	.000				
121.3	.000				
122.0	.000				
122.7	.000				
123.4	.000				
124.1	.000				
124.8	.000				
125.5	.000				
126.2	.000				
126.9	.000				
127.6	.000				
128.3	.000				
129.0	.000				
129.7	.000				
130.4	.000				
131.1	.000				
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132.5	.000				
133.2	.000				
133.9	.000				
134.6	.000				
135.3	.000				
136.0	.000				
136.7	.000				
137.4	.000				
138.1	.000				
138.8	.000				
139.5	.000				
140.2	.000				
140.9	.000				
141.6	.000				
142.3	.000				
143.0	.000				
143.7	.000				
144.4	.000				
145.1	.000				
145.8	.000				
146.5	.000				
147.2	.000				
147.9	.000				
148.6	.000				
149.3	.000				
149.9	.000				
150.6	.000				
151.3	.000				
152.0	.000				
152.7	.000				
153.4	.000				
154.1	.000				
154.8	.000				
155.5	.000				
156.2	.000				
156.9	.000				
157.6	.000				
158.3	.000				
159.0	.000				
159.7	.000				
160.4	.000				
161.1	.000				
161.8	.000				
162.5	.000				
163.2	.000				
163.9	.000				
164.6	.000				
165.3	.000				
166.0	.000				
166.7	.000				
167.4	.000				
168.1	.000				
168.8	.000				
169.5	.000				
170.2	.000				
170.9	.000				
171.6	.000				
172.3	.000				
173.0	.000				
173.7	.000				
174.4	.000				
175.1	.000				
175.8	.000				
176.5	.000				
177.2	.000				
177.9	.000				
178.6	.000				
179.3	.000				
179.9	.000				
180.6	.000				
181.3	.000				
182.0	.000				
182.7	.000				
183.4	.000				
184.1	.000				
184.8	.000				
185.5	.000				
186.2	.000				
186.9	.000				
187.6	.000				
188.3	.000				
189.0	.000				
189.7	.000				
190.4	.000				
191.1	.000				
191.8	.000				
192.5	.000				
193.2	.000				
193.9	.000				
194.6	.000				
195.3	.000				
196.0	.000				
196.7	.000				
197.4	.000				
198.1	.000				
198.8	.000				
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201.6	.000				
202.3	.000				
203.0	.000				
203.7	.000				
204.4	.000				
205.1	.000				
205.8	.000				
206.5	.000				
207.2	.000				
207.9	.000				
208.6	.000				
209.3	.000				
210.0	.000				
210.7	.000				
211.4	.000				
212.1	.000				
212.8	.000				
213.5	.000				
214.2	.000				
214.9	.000				
215.6	.000				
216.3	.000				
217.0	.000				
217.7	.000				
218.4	.000				
219.1	.000				
219.8	.000				
220.5	.000				
221.2	.000				
221.9	.000				
222.6	.000				
223.3	.000				
224.0	.000				
224.7	.000				
225.4	.000				
226.1	.000				
226.8	.000				
227.5	.000				
228.2	.000				
228.9	.000				
229.6	.000				
230.3	.000				
231.0	.000				
231.7	.000				
232.4	.000				
233.1	.000				
233.8	.000				
234.5	.000				
235.2	.000				
235.9	.000				
236.6	.000				
237.3	.000				
238.0	.000				
238.7	.000				
239.4	.000				
239.9	.000	</td			

TABLE 15.- Concluded

(d) Angle of scatter of 40°

Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV
48.4 ± .6	.000 ± .000	94.1 ± 1.7	.782 ± .069	283.6 ± 10.5	.394 ± .035
49.0 ± .6	.000 ± .000	95.9 ± 1.8	.802 ± .071	294.5 ± 11.2	.384 ± .034
49.6 ± .3	.126	97.8 ± 1.8	.753 ± .066	306.2 ± 12.0	.372 ± .033
50.1 ± .9	.106	99.7 ± 1.9	.755 ± .067	318.6 ± 12.9	.349 ± .031
51.2 ± .7	.105	101.6 ± 1.9	.755 ± .066	332.0 ± 13.8	.326 ± .029
51.7 ± .7	.094	103.6 ± 2.0	.734 ± .065	346.4 ± 14.9	.294 ± .027
52.1 ± .7	.099	105.7 ± 2.1	.744 ± .065	361.9 ± 16.1	.259 ± .023
52.6 ± .7	.093	107.9 ± 2.1	.735 ± .065	378.6 ± 17.4	.214 ± .019
53.1 ± .7	.093	110.1 ± 2.2	.740 ± .064	396.8 ± 18.9	.169 ± .015
53.6 ± .7	.091	112.4 ± 2.2	.721 ± .062	416.5 ± 20.6	.127 ± .012
54.1 ± .7	.091	114.8 ± 2.3	.697 ± .060	438.1 ± 22.5	.086 ± .008
54.6 ± .7	.091	117.2 ± 2.4	.682 ± .060	461.7 ± 24.7	.054 ± .005
55.1 ± .7	.093	119.8 ± 2.4	.686 ± .060	487.7 ± 27.3	.027 ± .002
55.6 ± .7	.093	122.4 ± 2.5	.651 ± .057	516.5 ± 30.3	.011 ± .001
56.1 ± .7	.091	125.1 ± 2.6	.652 ± .057	548.6 ± 33.9	.004 ± .000
56.6 ± .7	.091	127.9 ± 2.7	.635 ± .055	584.5 ± 38.1	.003 ± .000
57.1 ± .7	.091	130.9 ± 2.9	.624 ± .052	625.1 ± 43.2	.003 ± .000
57.6 ± .7	.093	133.9 ± 3.0	.621 ± .053	671.2 ± 49.4	.003 ± .000
58.1 ± .7	.093	137.0 ± 3.2	.625 ± .053		
58.6 ± .7	.093	140.3 ± 3.4	.619 ± .052		
59.1 ± .7	.091	143.7 ± 3.5	.625 ± .053		
59.6 ± .7	.091	147.2 ± 3.7	.604 ± .051		
60.1 ± .7	.093	150.9 ± 3.8	.612 ± .052		
60.6 ± .7	.093	154.7 ± 4.0	.572 ± .048		
61.1 ± .7	.093	158.6 ± 4.2	.550 ± .047		
61.6 ± .7	.093	162.8 ± 4.5	.536 ± .046		
62.1 ± .7	.093	167.1 ± 4.6	.517 ± .044		
62.6 ± .7	.093	171.9 ± 4.8	.495 ± .042		
63.1 ± .7	.093	176.3 ± 5.0	.499 ± .043		
63.6 ± .7	.093	181.2 ± 5.2	.482 ± .042		
64.1 ± .7	.093	186.4 ± 5.5	.491 ± .041		
64.6 ± .7	.093	191.7 ± 5.7	.480 ± .042		
65.1 ± .7	.093	197.4 ± 6.0	.487 ± .040		
65.6 ± .7	.093	203.3 ± 6.3	.465 ± .039		
66.1 ± .7	.093	209.5 ± 6.7	.453 ± .039		
66.6 ± .7	.093	216.1 ± 7.0	.447 ± .038		
67.1 ± .7	.093	223.0 ± 7.4	.436 ± .038		
67.6 ± .7	.093	230.2 ± 7.8	.437 ± .037		
68.1 ± .7	.093	246.0 ± 8.3	.423 ± .036		
68.6 ± .7	.093	254.6 ± 8.8	.410 ± .036		
69.1 ± .7	.093	263.7 ± 9.3	.412 ± .036		
69.6 ± .7	.093	273.3 ± 9.9	.393 ± .035		
70.1 ± .7	.093				
70.6 ± .7	.093				
71.1 ± .7	.093				
71.6 ± .7	.093				
72.1 ± .7	.093				
72.6 ± .7	.093				
73.1 ± .7	.093				
73.6 ± .7	.093				
74.1 ± .7	.093				
74.6 ± .7	.093				
75.1 ± .7	.093				
75.6 ± .7	.093				
76.1 ± .7	.093				
76.6 ± .7	.093				
77.1 ± .7	.093				
77.6 ± .7	.093				
78.1 ± .7	.093				
78.6 ± .7	.093				
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TABLE 16.- DOUBLE DIFFERENTIAL CROSS SECTIONS FOR PRODUCTION OF  
SECONDARY PROTONS FROM TUNGSTEN TARGET, 3.05 g/cm<sup>2</sup> THICK

[Incident proton energy, 558 MeV]

(a) Angle of scatter of 10°

Energy, MeV	Cross section, mb/sr-MeV						
47.9	.6	3.476	.272	92.2	.162	268.0	.016 ± .093
48.6	.6	3.552	.282	93.9	.166	277.9	.081 ± .090
49.2	.6	2.782	.225	95.5	.157	288.3	.046 ± .087
50.0	.6	2.363	.195	97.1	.170	299.5	.015 ± .084
51.2	.6	2.743	.229	98.7	.182	311.3	.012 ± .081
52.5	.6	2.015	.253	99.4	.159	324.1	.013 ± .080
53.7	.6	2.363	.200	101.3	.172	337.7	.014 ± .079
54.9	.6	2.672	.228	103.3	.152	352.4	.015 ± .074
56.2	.6	1.67	.167	105.2	.152	368.2	.016 ± .066
57.3	.6	2.537	.218	107.5	.158	385.3	.017 ± .058
58.5	.6	2.319	.201	109.6	.176	403.8	.019 ± .056
59.7	.6	2.460	.208	111.9	.178	424.0	.021 ± .056
60.9	.6	2.462	.214	114.2	.154	446.0	.023 ± .056
62.1	.6	2.039	.183	116.7	.143	470.2	.025 ± .056
63.3	.6	2.981	.174	119.1	.140	496.8	.028 ± .056
64.5	.6	2.310	.204	121.7	.144	526.3	.031 ± .056
65.7	.6	2.369	.211	124.4	.153	555.9	.034 ± .056
66.9	.6	2.258	.201	127.2	.152	585.0	.039 ± .056
68.1	.6	2.351	.210	130.0	.149	615.1	.044 ± .056
69.3	.6	2.126	.188	133.0	.140	645.6	.049 ± .056
70.5	.6	2.363	.210	136.1	.140	675.6	.054 ± .056
71.7	.6	2.217	.197	142.6	.146	705.0	.059 ± .056
72.9	.6	2.006	.178	146.0	.146	735.4	.064 ± .056
74.1	.6	2.076	.186	149.6	.146	765.9	.069 ± .056
75.3	.6	2.068	.185	153.3	.146	795.3	.074 ± .056
76.5	.6	2.073	.196	157.2	.146	825.8	.079 ± .056
77.7	.6	1.959	.177	161.2	.146	855.8	.084 ± .056
78.9	.6	2.173	.197	165.4	.146	885.8	.089 ± .056
80.1	.6	1.978	.179	169.8	.146	915.8	.094 ± .056
81.3	.6	2.021	.199	174.2	.146	945.8	.099 ± .056
82.5	.6	2.053	.188	179.4	.146	975.8	.104 ± .056
83.7	.6	2.042	.216	184.2	.146	1005.8	.109 ± .056
84.9	.6	2.092	.206	189.4	.146	1035.8	.114 ± .056
86.1	.6	2.091	.187	194.9	.146	1065.8	.119 ± .056
87.3	.6	2.068	.183	200.6	.146	1095.8	.124 ± .056
88.5	.6	2.031	.180	203.6	.146	1125.8	.129 ± .056
89.7	.6	2.013	.172	209.6	.146	1155.8	.134 ± .056
90.9	.6	2.013	.177	213.0	.146	1185.8	.139 ± .056
92.1	.6	2.068	.186	219.6	.146	1215.8	.144 ± .056
93.3	.6	2.031	.183	226.6	.146	1245.8	.149 ± .056
94.5	.6	2.078	.187	234.0	.146	1275.8	.154 ± .056
95.7	.6	2.013	.180	241.8	.146	1305.8	.159 ± .056
96.9	.6	2.092	.178	250.1	.146	1335.8	.164 ± .056
98.1	.6	2.075	.177	256.8	.146	1365.8	.169 ± .056

TABLE 16.- Continued  
(b) Angle of scatter of 20°

Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV
47.9	+ 3.820	92.9	+ 1.6	268.0	+ 9.5
48.6	+ 3.155	93.9	+ 1.7	277.9	+ 10.1
49.8	+ 3.593	95.5	+ 1.7	277.5	+ 10.7
50.5	+ 2.852	97.5	+ 1.8	299.5	+ 11.5
51.2	+ 2.578	99.4	+ 1.9	311.3	+ 12.2
52.0	+ 2.296	101.3	+ 1.9	324.1	+ 13.1
53.0	+ 2.014	103.3	+ 1.9	337.7	+ 14.1
54.0	+ 1.721	105.3	+ 1.9	352.4	+ 15.2
55.0	+ 1.425	107.5	+ 1.9	368.2	+ 16.4
56.0	+ 1.125	109.6	+ 1.9	385.3	+ 17.7
57.0	+ 0.824	111.4	+ 2.0	403.8	+ 19.3
58.0	+ 0.524	113.4	+ 2.0	424.0	+ 21.0
59.0	+ 0.226	115.4	+ 2.0	446.0	+ 23.0
60.0	+ 0.026	117.4	+ 2.0	470.2	+ 25.3
61.0	-	119.4	+ 2.0	496.8	+ 28.0
62.0	-	121.4	+ 2.0	526.3	+ 31.1
63.0	-	123.4	+ 2.0	559.1	+ 34.7
64.0	-	125.4	+ 2.0	596.0	+ 39.1
65.0	-	127.4	+ 2.0	637.6	+ 44.4
66.0	-	129.4	+ 2.0	685.1	+ 50.8
67.0	-	131.4	+ 2.0	-	-
68.0	-	133.4	+ 2.0	-	-
69.0	-	135.4	+ 2.0	-	-
70.0	-	137.4	+ 2.0	-	-
71.0	-	139.4	+ 2.0	-	-
72.0	-	141.4	+ 2.0	-	-
73.0	-	143.4	+ 2.0	-	-
74.0	-	145.4	+ 2.0	-	-
75.0	-	147.4	+ 2.0	-	-
76.0	-	149.4	+ 2.0	-	-
77.0	-	151.4	+ 2.0	-	-
78.0	-	153.4	+ 2.0	-	-
79.0	-	155.4	+ 2.0	-	-
80.0	-	157.4	+ 2.0	-	-
81.0	-	159.4	+ 2.0	-	-
82.0	-	161.4	+ 2.0	-	-
83.0	-	163.4	+ 2.0	-	-
84.0	-	165.4	+ 2.0	-	-
85.0	-	167.4	+ 2.0	-	-
86.0	-	169.4	+ 2.0	-	-
87.0	-	171.4	+ 2.0	-	-
88.0	-	173.4	+ 2.0	-	-
89.0	-	175.4	+ 2.0	-	-
90.0	-	177.4	+ 2.0	-	-
91.0	-	179.4	+ 2.0	-	-
92.0	-	181.4	+ 2.0	-	-
93.0	-	183.4	+ 2.0	-	-
94.0	-	185.4	+ 2.0	-	-
95.0	-	187.4	+ 2.0	-	-
96.0	-	189.4	+ 2.0	-	-
97.0	-	191.4	+ 2.0	-	-
98.0	-	193.4	+ 2.0	-	-
99.0	-	195.4	+ 2.0	-	-
100.0	-	197.4	+ 2.0	-	-
101.0	-	199.4	+ 2.0	-	-
102.0	-	201.4	+ 2.0	-	-
103.0	-	203.4	+ 2.0	-	-
104.0	-	205.4	+ 2.0	-	-
105.0	-	207.4	+ 2.0	-	-
106.0	-	209.4	+ 2.0	-	-
107.0	-	211.4	+ 2.0	-	-
108.0	-	213.4	+ 2.0	-	-
109.0	-	215.4	+ 2.0	-	-
110.0	-	217.4	+ 2.0	-	-
111.0	-	219.4	+ 2.0	-	-
112.0	-	221.4	+ 2.0	-	-
113.0	-	223.4	+ 2.0	-	-
114.0	-	225.4	+ 2.0	-	-
115.0	-	227.4	+ 2.0	-	-
116.0	-	229.4	+ 2.0	-	-
117.0	-	231.4	+ 2.0	-	-
118.0	-	233.4	+ 2.0	-	-
119.0	-	235.4	+ 2.0	-	-
120.0	-	237.4	+ 2.0	-	-
121.0	-	239.4	+ 2.0	-	-
122.0	-	241.4	+ 2.0	-	-
123.0	-	243.4	+ 2.0	-	-
124.0	-	245.4	+ 2.0	-	-
125.0	-	247.4	+ 2.0	-	-
126.0	-	249.4	+ 2.0	-	-
127.0	-	251.4	+ 2.0	-	-
128.0	-	253.4	+ 2.0	-	-
129.0	-	255.4	+ 2.0	-	-
130.0	-	257.4	+ 2.0	-	-
131.0	-	259.4	+ 2.0	-	-
132.0	-	261.4	+ 2.0	-	-
133.0	-	263.4	+ 2.0	-	-
134.0	-	265.4	+ 2.0	-	-
135.0	-	267.4	+ 2.0	-	-
136.0	-	269.4	+ 2.0	-	-
137.0	-	271.4	+ 2.0	-	-
138.0	-	273.4	+ 2.0	-	-
139.0	-	275.4	+ 2.0	-	-
140.0	-	277.4	+ 2.0	-	-
141.0	-	279.4	+ 2.0	-	-
142.0	-	281.4	+ 2.0	-	-
143.0	-	283.4	+ 2.0	-	-
144.0	-	285.4	+ 2.0	-	-
145.0	-	287.4	+ 2.0	-	-
146.0	-	289.4	+ 2.0	-	-
147.0	-	291.4	+ 2.0	-	-
148.0	-	293.4	+ 2.0	-	-
149.0	-	295.4	+ 2.0	-	-
150.0	-	297.4	+ 2.0	-	-
151.0	-	299.4	+ 2.0	-	-
152.0	-	301.4	+ 2.0	-	-
153.0	-	303.4	+ 2.0	-	-
154.0	-	305.4	+ 2.0	-	-
155.0	-	307.4	+ 2.0	-	-
156.0	-	309.4	+ 2.0	-	-
157.0	-	311.4	+ 2.0	-	-
158.0	-	313.4	+ 2.0	-	-
159.0	-	315.4	+ 2.0	-	-
160.0	-	317.4	+ 2.0	-	-
161.0	-	319.4	+ 2.0	-	-
162.0	-	321.4	+ 2.0	-	-
163.0	-	323.4	+ 2.0	-	-
164.0	-	325.4	+ 2.0	-	-
165.0	-	327.4	+ 2.0	-	-
166.0	-	329.4	+ 2.0	-	-
167.0	-	331.4	+ 2.0	-	-
168.0	-	333.4	+ 2.0	-	-
169.0	-	335.4	+ 2.0	-	-
170.0	-	337.4	+ 2.0	-	-
171.0	-	339.4	+ 2.0	-	-
172.0	-	341.4	+ 2.0	-	-
173.0	-	343.4	+ 2.0	-	-
174.0	-	345.4	+ 2.0	-	-
175.0	-	347.4	+ 2.0	-	-
176.0	-	349.4	+ 2.0	-	-
177.0	-	351.4	+ 2.0	-	-
178.0	-	353.4	+ 2.0	-	-
179.0	-	355.4	+ 2.0	-	-
180.0	-	357.4	+ 2.0	-	-
181.0	-	359.4	+ 2.0	-	-
182.0	-	361.4	+ 2.0	-	-
183.0	-	363.4	+ 2.0	-	-
184.0	-	365.4	+ 2.0	-	-
185.0	-	367.4	+ 2.0	-	-
186.0	-	369.4	+ 2.0	-	-
187.0	-	371.4	+ 2.0	-	-
188.0	-	373.4	+ 2.0	-	-
189.0	-	375.4	+ 2.0	-	-
190.0	-	377.4	+ 2.0	-	-
191.0	-	379.4	+ 2.0	-	-
192.0	-	381.4	+ 2.0	-	-
193.0	-	383.4	+ 2.0	-	-
194.0	-	385.4	+ 2.0	-	-
195.0	-	387.4	+ 2.0	-	-
196.0	-	389.4	+ 2.0	-	-
197.0	-	391.4	+ 2.0	-	-
198.0	-	393.4	+ 2.0	-	-
199.0	-	395.4	+ 2.0	-	-
200.0	-	397.4	+ 2.0	-	-
201.0	-	399.4	+ 2.0	-	-
202.0	-	401.4	+ 2.0	-	-
203.0	-	403.4	+ 2.0	-	-
204.0	-	405.4	+ 2.0	-	-
205.0	-	407.4	+ 2.0	-	-
206.0	-	409.4	+ 2.0	-	-
207.0	-	411.4	+ 2.0	-	-
208.0	-	413.4	+ 2.0	-	-
209.0	-	415.4	+ 2.0	-	-
210.0	-	417.4	+ 2.0	-	-
211.0	-	419.4	+ 2.0	-	-
212.0	-	421.4	+ 2.0	-	-
213.0	-	423.4	+ 2.0	-	-
214.0	-	425.4	+ 2.0	-	-
215.0	-	427.4	+ 2.0	-	-
216.0	-	429.4	+ 2.0	-	-
217.0	-	431.4	+ 2.0	-	-
218.0	-	433.4	+ 2.0	-	-
219.0	-	435.4	+ 2.0	-	-
220.0	-	437.4	+ 2.0	-	-
221.0	-	439.4	+ 2.0	-	-
222.0	-	441.4	+ 2.0	-	-
223.0	-	443.4	+ 2.0	-	-
224.0	-	445.4	+ 2.0	-	-
225.0	-	447.4	+ 2.0	-	-
226.0	-	449.4	+ 2.0	-	-
227.0	-	451.4	+ 2.0	-	-
228.0	-	453.4	+ 2.0	-	-
229.0	-	455.4	+ 2.0	-	-
230.0	-	457.4	+ 2.0	-	-
231.0	-	459.4	+ 2.0	-	-
232.0	-	461.4	+ 2.0	-	-
233.0	-	463.4	+ 2.0	-	-
234.0	-	465.4	+ 2.0	-	-
235.0	-	467.4	+ 2.0	-	-
236.0	-	469.4	+ 2.0	-	-
237.0	-	471.4	+ 2.0	-	-
238.0	-	473.4	+ 2.0	-	-
239.0	-	475.4	+ 2.0	-	-
240.0	-	477.4	+ 2.0	-	-
241.0	-	479.4	+ 2.0	-	-
242.0	-	481.4	+ 2.0	-	-
243.0	-	483.4	+ 2.0	-	-
244.0	-	485.4	+ 2.0	-	-
245.0	-	487.4	+ 2.0	-	-
246.0	-	489.4	+ 2.0	-	-
247.0	-	491.4	+ 2.0	-	-
248.0	-	493.4	+ 2.0	-	-
249.0	-	495.4	+ 2.0	-	-
250.0	-	497.4	+ 2.0	-	-
251.0	-	499.4	+ 2.0	-	-
252.0	-	501.4	+ 2.0	-	-
253.0	-	503.4	+ 2.0	-	-
254.0	-	505.4	+ 2.0	-	-
255.0	-	507.4	+ 2.0	-	-
256.0	-	509.4	+ 2.0	-	-
257.0	-	511.4	+ 2.0	-	-
258.0	-	513.4	+ 2.0	-	-
259.0	-	515.4	+ 2.0	-	-
260.0	-	517.4	+ 2.0	-	-
261.0	-	519.4	+ 2.0	-	-
262.0	-	521.4	+ 2.0	-	-
263.0	-	523.4	+ 2.0	-	-
264.0	-	525.4	+ 2.0	-	-
265.0	-	527.4	+ 2.0	-	-
266.0	-	529.4	+ 2.0	-	-
267.0	-	531.4	+ 2.0	-	-
268.0	-	533.4	+ 2.0	-	-
269.0	-	535.4	+ 2.0	-	-
270.0	-	537.4	+ 2.0	-	-</

TABLE 16.- Continued  
(c) Angle of scatter of 30°

Energy, MeV	Cross section, mb/sr-MeV						
47.9 ± .6	3.951 ± .309	92.2 ± 1.6	1.752 ± .156	268.0 ± 9.5	.628 ± .057		
48.2 ± .6	3.938 ± .233	93.7 ± 1.7	1.734 ± .154	277.9 ± 10.1	.637 ± .057		
49.5 ± .6	3.912 ± .205	95.7 ± 1.7	1.640 ± .145	286.3 ± 10.7	.625 ± .056		
50.8 ± .6	3.873 ± .215	97.5 ± 1.7	1.554 ± .139	299.5 ± 11.5	.629 ± .057		
52.1 ± .6	3.842 ± .237	99.5 ± 1.7	1.632 ± .137	311.3 ± 12.2	.654 ± .059		
53.4 ± .6	3.803 ± .183	101.3 ± 1.7	1.518 ± .144	324.1 ± 13.1	.688 ± .063		
54.7 ± .6	3.763 ± .189	103.3 ± 1.7	1.479 ± .134	337.7 ± 14.1	.738 ± .067		
56.0 ± .6	3.722 ± .196	105.3 ± 1.7	1.449 ± .131	352.4 ± 15.2	.763 ± .070		
57.3 ± .6	3.682 ± .199	107.3 ± 1.7	1.414 ± .129	368.2 ± 16.4	.793 ± .075		
58.7 ± .6	3.642 ± .177	109.3 ± 1.7	1.382 ± .141	385.3 ± 17.7	.835 ± .079		
60.0 ± .6	3.603 ± .184	111.3 ± 1.7	1.488 ± .132	403.8 ± 19.3	.866 ± .081		
61.3 ± .6	3.563 ± .190	113.3 ± 1.7	1.445 ± .127	424.0 ± 21.0	.816 ± .077		
62.6 ± .6	3.522 ± .187	115.3 ± 1.7	1.404 ± .123	446.0 ± 23.0	.722 ± .068		
63.9 ± .6	3.482 ± .196	117.3 ± 1.7	1.360 ± .119	470.2 ± 25.3	.590 ± .056		
65.2 ± .6	3.442 ± .199	119.3 ± 1.7	1.320 ± .119	496.8 ± 28.0	.395 ± .038		
66.5 ± .6	3.402 ± .177	121.3 ± 1.7	1.380 ± .115	526.3 ± 31.1	.232 ± .023		
67.8 ± .6	3.362 ± .184	123.3 ± 1.7	1.340 ± .115	559.1 ± 34.7	.106 ± .010		
69.1 ± .6	3.322 ± .190	125.3 ± 1.7	1.300 ± .110	596.0 ± 39.1	.033 ± .003		
70.4 ± .6	3.282 ± .187	127.3 ± 1.7	1.260 ± .110	637.6 ± 44.4	.016 ± .001		
71.7 ± .6	3.242 ± .196	129.3 ± 1.7	1.220 ± .108	685.1 ± 50.8	.001		
73.0 ± .6	3.202 ± .199	131.3 ± 1.7	1.180 ± .103				
74.3 ± .6	3.162 ± .177	133.3 ± 1.7	1.140 ± .103				
75.6 ± .6	3.122 ± .184	135.3 ± 1.7	1.100 ± .103				
76.9 ± .6	3.082 ± .190	137.3 ± 1.7	1.060 ± .103				
78.2 ± .6	3.042 ± .187	139.3 ± 1.7	1.020 ± .103				
79.5 ± .6	3.002 ± .196	141.3 ± 1.7	980 ± .103				
80.8 ± .6	2.962 ± .177	143.3 ± 1.7	940 ± .103				
82.1 ± .6	2.922 ± .184	145.3 ± 1.7	900 ± .103				
83.4 ± .6	2.882 ± .190	147.3 ± 1.7	860 ± .103				
84.7 ± .6	2.842 ± .187	149.3 ± 1.7	820 ± .103				
86.0 ± .6	2.802 ± .196	151.3 ± 1.7	780 ± .103				
87.3 ± .6	2.762 ± .177	153.3 ± 1.7	740 ± .103				
88.6 ± .6	2.722 ± .184	155.3 ± 1.7	700 ± .103				
89.9 ± .6	2.682 ± .190	157.3 ± 1.7	660 ± .103				
91.2 ± .6	2.642 ± .187	159.3 ± 1.7	620 ± .103				
92.5 ± .6	2.602 ± .196	161.3 ± 1.7	580 ± .103				
93.8 ± .6	2.562 ± .177	163.3 ± 1.7	540 ± .103				
95.1 ± .6	2.522 ± .184	165.3 ± 1.7	500 ± .103				
96.4 ± .6	2.482 ± .190	167.3 ± 1.7	460 ± .103				
97.7 ± .6	2.442 ± .187	169.3 ± 1.7	420 ± .103				
99.0 ± .6	2.402 ± .196	171.3 ± 1.7	380 ± .103				
100.3 ± .6	2.362 ± .177	173.3 ± 1.7	340 ± .103				
101.6 ± .6	2.322 ± .184	175.3 ± 1.7	300 ± .103				
102.9 ± .6	2.282 ± .190	177.3 ± 1.7	260 ± .103				
104.2 ± .6	2.242 ± .187	179.3 ± 1.7	220 ± .103				
105.5 ± .6	2.202 ± .196	181.3 ± 1.7	180 ± .103				
106.8 ± .6	2.162 ± .177	183.3 ± 1.7	140 ± .103				
108.1 ± .6	2.122 ± .184	185.3 ± 1.7	100 ± .103				
109.4 ± .6	2.082 ± .190	187.3 ± 1.7	60 ± .103				
110.7 ± .6	2.042 ± .187	189.3 ± 1.7	20 ± .103				
112.0 ± .6	2.002 ± .196	191.3 ± 1.7	± .103				
113.3 ± .6	1.962 ± .177	193.3 ± 1.7					
114.6 ± .6	1.922 ± .184	195.3 ± 1.7					
115.9 ± .6	1.882 ± .190	197.3 ± 1.7					
117.2 ± .6	1.842 ± .187	199.3 ± 1.7					
118.5 ± .6	1.802 ± .196	201.3 ± 1.7					
119.8 ± .6	1.762 ± .177	203.3 ± 1.7					
121.1 ± .6	1.722 ± .184	205.3 ± 1.7					
122.4 ± .6	1.682 ± .190	207.3 ± 1.7					
123.7 ± .6	1.642 ± .187	209.3 ± 1.7					
125.0 ± .6	1.602 ± .196	211.3 ± 1.7					
126.3 ± .6	1.562 ± .177	213.3 ± 1.7					
127.6 ± .6	1.522 ± .184	215.3 ± 1.7					
128.9 ± .6	1.482 ± .190	217.3 ± 1.7					
130.2 ± .6	1.442 ± .187	219.3 ± 1.7					
131.5 ± .6	1.402 ± .196	221.3 ± 1.7					
132.8 ± .6	1.362 ± .177	223.3 ± 1.7					
134.1 ± .6	1.322 ± .184	225.3 ± 1.7					
135.4 ± .6	1.282 ± .190	227.3 ± 1.7					
136.7 ± .6	1.242 ± .187	229.3 ± 1.7					
138.0 ± .6	1.202 ± .196	231.3 ± 1.7					
139.3 ± .6	1.162 ± .177	233.3 ± 1.7					
140.6 ± .6	1.122 ± .184	235.3 ± 1.7					
141.9 ± .6	1.082 ± .190	237.3 ± 1.7					
143.2 ± .6	1.042 ± .187	239.3 ± 1.7					
144.5 ± .6	1.002 ± .196	241.3 ± 1.7					
145.8 ± .6	96.2 ± .177	243.3 ± 1.7					
147.1 ± .6	92.2 ± .184	245.3 ± 1.7					
148.4 ± .6	88.2 ± .190	247.3 ± 1.7					
149.7 ± .6	84.2 ± .187	249.3 ± 1.7					
151.0 ± .6	80.2 ± .196	251.3 ± 1.7					
152.3 ± .6	76.2 ± .177	253.3 ± 1.7					
153.6 ± .6	72.2 ± .184	255.3 ± 1.7					
154.9 ± .6	68.2 ± .190	257.3 ± 1.7					
156.2 ± .6	64.2 ± .187	259.3 ± 1.7					
157.5 ± .6	60.2 ± .196	261.3 ± 1.7					
158.8 ± .6	56.2 ± .177	263.3 ± 1.7					
160.1 ± .6	52.2 ± .184	265.3 ± 1.7					
161.4 ± .6	48.2 ± .190	267.3 ± 1.7					
162.7 ± .6	44.2 ± .187	269.3 ± 1.7					
164.0 ± .6	40.2 ± .196	271.3 ± 1.7					
165.3 ± .6	36.2 ± .177	273.3 ± 1.7					
166.6 ± .6	32.2 ± .184	275.3 ± 1.7					
167.9 ± .6	28.2 ± .190	277.3 ± 1.7					
169.2 ± .6	24.2 ± .187	279.3 ± 1.7					
170.5 ± .6	20.2 ± .196	281.3 ± 1.7					
171.8 ± .6	16.2 ± .177	283.3 ± 1.7					
173.1 ± .6	12.2 ± .184	285.3 ± 1.7					
174.4 ± .6	8.2 ± .190	287.3 ± 1.7					
175.7 ± .6	4.2 ± .187	289.3 ± 1.7					
177.0 ± .6	0.2 ± .196	291.3 ± 1.7					
178.3 ± .6	-4.2 ± .177	293.3 ± 1.7					
179.6 ± .6	-8.2 ± .184	295.3 ± 1.7					
180.9 ± .6	-12.2 ± .190	297.3 ± 1.7					
182.2 ± .6	-16.2 ± .187	299.3 ± 1.7					
183.5 ± .6	-20.2 ± .196	301.3 ± 1.7					
184.8 ± .6	-24.2 ± .177	303.3 ± 1.7					
186.1 ± .6	-28.2 ± .184	305.3 ± 1.7					
187.4 ± .6	-32.2 ± .190	307.3 ± 1.7					
188.7 ± .6	-36.2 ± .187	309.3 ± 1.7					
190.0 ± .6	-40.2 ± .196	311.3 ± 1.7					
191.3 ± .6	-44.2 ± .177	313.3 ± 1.7					
192.6 ± .6	-48.2 ± .184	315.3 ± 1.7					
193.9 ± .6	-52.2 ± .190	317.3 ± 1.7					
195.2 ± .6	-56.2 ± .187	319.3 ± 1.7					
196.5 ± .6	-60.2 ± .196	321.3 ± 1.7					
197.8 ± .6	-64.2 ± .177	323.3 ± 1.7					
199.1 ± .6	-68.2 ± .184	325.3 ± 1.7					
200.4 ± .6	-72.2 ± .190	327.3 ± 1.7					
201.7 ± .6	-76.2 ± .187	329.3 ± 1.7					
203.0 ± .6	-80.2 ± .196	331.3 ± 1.7					
204.3 ± .6	-84.2 ± .177	333.3 ± 1.7					
205.6 ± .6	-88.2 ± .184	335.3 ± 1.7					
206.9 ± .6	-92.2 ± .190	337.3 ± 1.7					
208.2 ± .6	-96.2 ± .187	339.3 ± 1.7					
209.5 ± .6	-100.2 ± .196	341.3 ± 1.7					
210.8 ± .6	-104.2 ± .177	343.3 ± 1.7					
212.1 ± .6	-108.2 ± .184	345.3 ± 1.7					
213.4 ± .6	-112.2 ± .190	347.3 ± 1.7					
214.7 ± .6	-116.2 ± .187	349.3 ± 1.7					
216.0 ± .6	-120.2 ± .196	351.3 ± 1.7					
217.3 ± .6	-124.2 ± .177	353.3 ± 1.7					
218.6 ± .6	-128.2 ± .184	355.3 ± 1.7					
219.9 ± .6	-132.2 ± .190	357.3 ± 1.7					
221.2 ± .6	-136.2 ± .187	359.3 ± 1.7					
222.5 ± .6	-140.2 ± .196	361.3 ± 1.7					
223.8 ± .6	-144.2 ± .177	363.3 ± 1.7					
225.1 ± .6	-148.2 ± .184	365.3 ± 1.7					
226.4 ± .6	-152.2 ± .190	367.3 ± 1.7					
227.7 ± .6	-156.2 ± .187	369.3 ± 1.7					
229.0 ± .6	-160.2 ± .196	371.3 ± 1.7					
230.3 ± .6	-164.2 ± .177	373.3 ± 1.7					
231.6 ± .6	-168.2 ± .184	375.3 ± 1.7					
232.9 ± .6	-172.2 ± .190	377.3 ± 1.7					
234.2 ± .6	-176.2 ± .187	379.3 ± 1.7					
235.5 ± .6	-180.2 ± .196	381.3 ± 1.7					
236.8 ± .6	-184.2 ± .177	383.3 ± 1.7					
238.1 ± .6	-188.2 ± .184	385.3 ± 1.7					
239.4 ± .6	-192.2 ± .190	387.3 ± 1.7					
240.7 ± .6	-196.2 ± .187	389.3 ± 1.7					
242.0 ± .6	-200.2 ± .196						

TABLE 16.- Continued  
(d) Angle of scatter of 40°

TABLE 16.- Continued

(e) Angle of scatter of 50°

Energy, MeV	Cross section, mb/sr-MeV							
.6	3.017	.236	1.6	1.6	1.352	.120	268.0	.5
.6	3.589	.205	1.7	1.7	1.379	.123	277.9	.1
.6	2.536	.205	1.8	1.8	1.296	.115	288.3	.7
.6	2.283	.188	1.9	1.9	1.304	.115	299.5	.5
.6	2.104	.175	2.0	2.0	1.296	.114	311.3	.2
.6	1.848	.155	2.1	2.1	1.275	.112	324.1	.1
.6	1.914	.162	2.2	2.2	1.251	.110	337.7	.1
.6	1.264	.167	2.3	2.3	1.233	.109	352.4	.2
.6	1.167	.167	2.4	2.4	1.230	.109	368.2	.4
.6	1.109	.160	2.5	2.5	1.224	.109	385.3	.3
.6	1.111	.141	2.6	2.6	1.168	.103	403.8	.3
.6	1.116	.140	2.7	2.7	1.152	.101	424.0	.0
.6	1.119	.140	2.8	2.8	1.123	.098	446.0	.0
.6	1.121	.140	2.9	2.9	1.121	.098	470.2	.25
.6	1.121	.140	3.0	3.0	1.075	.094	496.8	.28
.6	1.121	.140	3.1	3.1	1.097	.096	526.3	.31
.6	1.121	.140	3.2	3.2	1.078	.091	559.1	.34
.6	1.121	.140	3.3	3.3	1.058	.089	596.0	.39
.6	1.121	.140	3.4	3.4	1.017	.086	637.6	.44
.6	1.121	.140	3.5	3.5	1.017	.086	685.1	.50
.6	1.121	.140	3.6	3.6	1.017	.086	731.1	.51
.6	1.121	.140	3.7	3.7	1.017	.086	774.1	.53
.6	1.121	.140	3.8	3.8	1.017	.086	817.7	.56
.6	1.121	.140	3.9	3.9	1.017	.086	860.0	.59
.6	1.121	.140	4.0	4.0	1.017	.086	903.4	.62
.6	1.121	.140	4.1	4.1	1.017	.086	946.8	.65
.6	1.121	.140	4.2	4.2	1.017	.086	989.2	.68
.6	1.121	.140	4.3	4.3	1.017	.086	1032.6	.71
.6	1.121	.140	4.4	4.4	1.017	.086	1075.0	.75
.6	1.121	.140	4.5	4.5	1.017	.086	1117.4	.78
.6	1.121	.140	4.6	4.6	1.017	.086	1159.8	.81
.6	1.121	.140	4.7	4.7	1.017	.086	1202.2	.84
.6	1.121	.140	4.8	4.8	1.017	.086	1244.6	.87
.6	1.121	.140	4.9	4.9	1.017	.086	1287.0	.90
.6	1.121	.140	5.0	5.0	1.017	.086	1329.4	.93
.6	1.121	.140	5.1	5.1	1.017	.086	1371.8	.96
.6	1.121	.140	5.2	5.2	1.017	.086	1414.2	.99
.6	1.121	.140	5.3	5.3	1.017	.086	1456.6	.02
.6	1.121	.140	5.4	5.4	1.017	.086	1500.0	.05
.6	1.121	.140	5.5	5.5	1.017	.086	1543.4	.08
.6	1.121	.140	5.6	5.6	1.017	.086	1585.8	.11
.6	1.121	.140	5.7	5.7	1.017	.086	1628.2	.14
.6	1.121	.140	5.8	5.8	1.017	.086	1670.6	.17
.6	1.121	.140	5.9	5.9	1.017	.086	1713.0	.20
.6	1.121	.140	6.0	6.0	1.017	.086	1755.4	.23
.6	1.121	.140	6.1	6.1	1.017	.086	1797.8	.26
.6	1.121	.140	6.2	6.2	1.017	.086	1840.2	.29
.6	1.121	.140	6.3	6.3	1.017	.086	1882.6	.32
.6	1.121	.140	6.4	6.4	1.017	.086	1925.0	.35
.6	1.121	.140	6.5	6.5	1.017	.086	1967.4	.38
.6	1.121	.140	6.6	6.6	1.017	.086	2009.8	.41
.6	1.121	.140	6.7	6.7	1.017	.086	2052.2	.44
.6	1.121	.140	6.8	6.8	1.017	.086	2094.6	.47
.6	1.121	.140	6.9	6.9	1.017	.086	2137.0	.50
.6	1.121	.140	7.0	7.0	1.017	.086	2179.4	.53
.6	1.121	.140	7.1	7.1	1.017	.086	2221.8	.56
.6	1.121	.140	7.2	7.2	1.017	.086	2264.2	.59
.6	1.121	.140	7.3	7.3	1.017	.086	2306.6	.62
.6	1.121	.140	7.4	7.4	1.017	.086	2348.0	.65
.6	1.121	.140	7.5	7.5	1.017	.086	2390.4	.68
.6	1.121	.140	7.6	7.6	1.017	.086	2431.8	.71
.6	1.121	.140	7.7	7.7	1.017	.086	2473.2	.74
.6	1.121	.140	7.8	7.8	1.017	.086	2514.6	.77
.6	1.121	.140	7.9	7.9	1.017	.086	2556.0	.80
.6	1.121	.140	8.0	8.0	1.017	.086	2597.4	.83
.6	1.121	.140	8.1	8.1	1.017	.086	2638.8	.86
.6	1.121	.140	8.2	8.2	1.017	.086	2680.2	.89
.6	1.121	.140	8.3	8.3	1.017	.086	2721.6	.92
.6	1.121	.140	8.4	8.4	1.017	.086	2763.0	.95
.6	1.121	.140	8.5	8.5	1.017	.086	2804.4	.98
.6	1.121	.140	8.6	8.6	1.017	.086	2845.8	.01
.6	1.121	.140	8.7	8.7	1.017	.086	2887.2	.04
.6	1.121	.140	8.8	8.8	1.017	.086	2928.6	.07
.6	1.121	.140	8.9	8.9	1.017	.086	2970.0	.10
.6	1.121	.140	9.0	9.0	1.017	.086	3011.4	.13
.6	1.121	.140	9.1	9.1	1.017	.086	3052.8	.16
.6	1.121	.140	9.2	9.2	1.017	.086	3094.2	.19
.6	1.121	.140	9.3	9.3	1.017	.086	3135.6	.22
.6	1.121	.140	9.4	9.4	1.017	.086	3177.0	.25
.6	1.121	.140	9.5	9.5	1.017	.086	3218.4	.28
.6	1.121	.140	9.6	9.6	1.017	.086	3259.8	.31
.6	1.121	.140	9.7	9.7	1.017	.086	3301.2	.34
.6	1.121	.140	9.8	9.8	1.017	.086	3342.6	.37
.6	1.121	.140	9.9	9.9	1.017	.086	3384.0	.40
.6	1.121	.140	10.0	10.0	1.017	.086	3425.4	.43
.6	1.121	.140	10.1	10.1	1.017	.086	3466.8	.46
.6	1.121	.140	10.2	10.2	1.017	.086	3508.2	.49
.6	1.121	.140	10.3	10.3	1.017	.086	3550.6	.52
.6	1.121	.140	10.4	10.4	1.017	.086	3592.0	.55
.6	1.121	.140	10.5	10.5	1.017	.086	3633.4	.58
.6	1.121	.140	10.6	10.6	1.017	.086	3674.8	.61
.6	1.121	.140	10.7	10.7	1.017	.086	3716.2	.64
.6	1.121	.140	10.8	10.8	1.017	.086	3757.6	.67
.6	1.121	.140	10.9	10.9	1.017	.086	3809.0	.70
.6	1.121	.140	11.0	11.0	1.017	.086	3850.4	.73
.6	1.121	.140	11.1	11.1	1.017	.086	3891.8	.76
.6	1.121	.140	11.2	11.2	1.017	.086	3933.2	.79
.6	1.121	.140	11.3	11.3	1.017	.086	3974.6	.82
.6	1.121	.140	11.4	11.4	1.017	.086	4016.0	.85
.6	1.121	.140	11.5	11.5	1.017	.086	4057.4	.88
.6	1.121	.140	11.6	11.6	1.017	.086	4108.8	.91
.6	1.121	.140	11.7	11.7	1.017	.086	4150.2	.94
.6	1.121	.140	11.8	11.8	1.017	.086	4191.6	.97
.6	1.121	.140	11.9	11.9	1.017	.086	4233.0	.00
.6	1.121	.140	12.0	12.0	1.017	.086	4274.4	.03
.6	1.121	.140	12.1	12.1	1.017	.086	4315.8	.06
.6	1.121	.140	12.2	12.2	1.017	.086	4357.2	.09
.6	1.121	.140	12.3	12.3	1.017	.086	4408.6	.12
.6	1.121	.140	12.4	12.4	1.017	.086	4450.0	.15
.6	1.121	.140	12.5	12.5	1.017	.086	4491.4	.18
.6	1.121	.140	12.6	12.6	1.017	.086	4532.8	.21
.6	1.121	.140	12.7	12.7	1.017	.086	4574.2	.24
.6	1.121	.140	12.8	12.8	1.017	.086	4615.6	.27
.6	1.121	.140	12.9	12.9	1.017	.086	4657.0	.30
.6	1.121	.140	13.0	13.0	1.017	.086	4708.4	.33
.6	1.121	.140	13.1	13.1	1.017	.086	4759.8	.36
.6	1.121	.140	13.2	13.2	1.017	.086	4801.2	.39
.6	1.121	.140	13.3	13.3	1.017	.086	4852.6	.42
.6	1.121	.140	13.4	13.4	1.017	.086	4904.0	.45
.6	1.121	.140	13.5	13.5	1.017	.086	4955.4	.48
.6	1.121	.140	13.6	13.6	1.017	.086	5006.8	.51
.6	1.121	.140	13.7	13.7	1.017	.086	5058.2	.54
.6	1.121	.140	13.8	13.8	1.017	.086	5110.6	.57
.6	1.121	.140	13.9	13.9	1.017	.086	5162.0	.60
.6	1.121	.140	14.0	14.0	1.017	.086	5213.4	.63
.6	1.121	.140	14.1	14.1	1.017	.086	5264.8	.66
.6	1.121	.140	14.2	14.2	1.017	.086	5316.2	.69
.6	1.121	.140	14.3	14.3	1.017	.086	5367.6	.72
.6	1.121	.140	14.4	14.4	1.017	.086	5419.0	.75
.6	1.121	.140	14.5	14.5	1.017	.086	5470.4	.78
.6	1.121	.140	14.6	14.6	1.017	.086	5521.8	.81
.6	1.121	.140	14.7	14.7	1.017	.086	5573.2	.84
.6	1.121	.140	14.8	14.8	1.017	.086	5624.6	.87
.6	1.121	.140	14.9	14.9	1.017	.086	5676.0	.90
.6	1.121	.140	15.0	15.0	1.017	.086	5727.4	.93
.6	1.							

TABLE 16.- Concluded

(f) Angle of scatter of  $60^\circ$ 

Energy, MeV	Cross section, mb/sr-MeV						
48.4	.266	94.1	.17	1.364	.121	.139	.012
49.0	.195	95.9	.18	1.220	.109	.120	.011
49.6	.184	97.8	.18	1.198	.106	.106	.009
50.3	.174	99.7	.19	1.220	.108	.12.9	.007
51.0	.170	101.6	.19	1.192	.105	13.8	.006
51.7	.167	103.6	.20	1.189	.105	14.9	.005
52.4	.167	105.7	.21	1.161	.102	16.1	.037
53.1	.164	107.9	.21	1.157	.102	17.4	.027
53.8	.153	110.1	.21	1.141	.102	18.9	.018
54.5	.132	112.4	.21	1.152	.103	20.6	.010
55.2	.146	114.8	.21	1.106	.098	22.5	.006
55.9	.138	117.2	.21	1.106	.096	24.7	.004
56.6	.147	119.8	.21	1.106	.093	27.3	.003
57.3	.138	122.4	.21	1.106	.093	30.3	.003
58.0	.149	125.9	.21	1.106	.093	33.7	.003
58.7	.145	127.9	.21	1.106	.093	36.1	.003
59.4	.146	130.9	.21	1.106	.093	38.1	.003
60.1	.146	133.9	.21	1.106	.093	43.2	.003
60.8	.146	137.0	.21	1.106	.093	49.4	.003
61.5	.146	140.3	.21	1.106	.093	56.1	.003
62.2	.146	143.7	.21	1.106	.093	62.5	.003
62.9	.146	146.2	.21	1.106	.093	67.1	.003
63.6	.146	149.7	.21	1.106	.093	71.7	.003
64.3	.146	153.2	.21	1.106	.093	76.1	.003
65.0	.146	156.7	.21	1.106	.093	80.7	.003
65.7	.146	160.2	.21	1.106	.093	85.3	.003
66.4	.146	163.7	.21	1.106	.093	90.9	.003
67.1	.146	167.2	.21	1.106	.093	96.5	.003
67.8	.146	170.7	.21	1.106	.093	102.1	.003
68.5	.146	174.2	.21	1.106	.093	107.7	.003
69.2	.146	177.7	.21	1.106	.093	113.3	.003
69.9	.146	181.2	.21	1.106	.093	118.9	.003
70.6	.146	184.7	.21	1.106	.093	124.5	.003
71.3	.146	188.2	.21	1.106	.093	130.1	.003
72.0	.146	191.7	.21	1.106	.093	135.7	.003
72.7	.146	195.2	.21	1.106	.093	141.3	.003
73.4	.146	198.7	.21	1.106	.093	146.9	.003
74.1	.146	202.2	.21	1.106	.093	152.5	.003
74.8	.146	205.7	.21	1.106	.093	158.1	.003
75.5	.146	209.2	.21	1.106	.093	163.7	.003
76.2	.146	212.7	.21	1.106	.093	169.3	.003
76.9	.146	216.2	.21	1.106	.093	174.9	.003
77.6	.146	219.7	.21	1.106	.093	180.5	.003
78.3	.146	223.2	.21	1.106	.093	186.1	.003
79.0	.146	226.7	.21	1.106	.093	191.7	.003
79.7	.146	230.2	.21	1.106	.093	197.4	.003
80.4	.146	233.7	.21	1.106	.093	203.0	.003
81.1	.146	237.2	.21	1.106	.093	209.5	.003
81.8	.146	240.7	.21	1.106	.093	216.1	.003
82.5	.146	244.2	.21	1.106	.093	223.0	.003
83.2	.146	247.7	.21	1.106	.093	230.6	.003
83.9	.146	251.2	.21	1.106	.093	237.9	.003
84.6	.146	254.7	.21	1.106	.093	246.0	.003
85.3	.146	258.2	.21	1.106	.093	254.6	.003
86.0	.146	261.7	.21	1.106	.093	263.7	.003
86.7	.146	265.2	.21	1.106	.093	273.3	.003
87.4	.146	268.7	.21	1.106	.093	280.4	.003

TABLE 17.- DOUBLE DIFFERENTIAL CROSS SECTIONS FOR PRODUCTION OF  
SECONDARY PROTONS FROM LEAD TARGET, 3.91 g/cm<sup>2</sup> THICK

[Incident proton energy, 558 MeV]

(a) Angle of scatter of 10°

Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV
47.9 ± .6	4.938 ± .387	93.1 ± 1.7	1.936 ± .172	279.5 ± 10.3	1.056 ± .038
49.2 ± .6	3.996 ± .317	94.7 ± 1.7	1.813 ± .161	290.2 ± 11.0	1.046 ± .097
50.5 ± .6	4.344 ± .367	95.3 ± 1.8	1.912 ± .169	301.6 ± 11.8	.559 ± .089
51.8 ± .6	3.981 ± .351	96.9 ± 1.9	2.072 ± .179	313.8 ± 12.6	.941 ± .088
53.1 ± .6	2.985 ± .246	100.9 ± 2.0	2.183 ± .183	326.9 ± 13.5	.898 ± .084
54.5 ± .6	2.585 ± .216	102.5 ± 2.0	2.183 ± .193	340.9 ± 14.5	.885 ± .083
55.8 ± .6	2.339 ± .239	104.6 ± 2.1	1.894 ± .167	356.1 ± 15.7	.073
57.1 ± .6	2.272 ± .192	106.7 ± 2.1	2.026 ± .173	372.4 ± 16.9	.074
58.4 ± .6	1.914 ± .163	108.9 ± 2.2	1.876 ± .167	390.1 ± 18.4	.074
59.7 ± .6	2.444 ± .210	111.2 ± 2.3	1.875 ± .167	408.3 ± 20.0	.082
61.0 ± .6	2.771 ± .238	113.5 ± 2.3	1.929 ± .171	430.3 ± 21.9	.078
62.3 ± .6	2.651 ± .229	115.8 ± 2.3	1.834 ± .162	453.3 ± 24.9	.079
63.6 ± .6	2.255 ± .195	117.1 ± 2.5	1.834 ± .162	478.5 ± 26.5	.079
64.9 ± .6	2.356 ± .204	118.4 ± 2.5	1.902 ± .174	506.5 ± 29.4	.106
66.2 ± .6	2.331 ± .231	121.0 ± 2.6	1.906 ± .174	537.5 ± 32.7	.214
67.5 ± .6	2.651 ± .214	123.7 ± 2.7	1.679 ± .147	572.2 ± 36.8	.512
68.8 ± .6	2.356 ± .214	126.5 ± 2.8	1.932 ± .169	611.3 ± 41.6	.818
70.1 ± .6	2.338 ± .189	129.4 ± 2.9	1.739 ± .146	655.7 ± 47.4	.016
71.4 ± .6	2.438 ± .189	132.3 ± 2.9	1.739 ± .146	611.3 ± 41.6	.122
72.7 ± .6	2.138 ± .200	135.7 ± 3.0	1.739 ± .146	655.7 ± 47.4	.146 ± .016
74.0 ± .6	2.406 ± .259	138.7 ± 3.2	1.739 ± .147		
75.3 ± .6	2.210 ± .215	142.0 ± 3.2	1.739 ± .147		
76.6 ± .6	2.356 ± .196	145.5 ± 3.6	1.739 ± .151		
77.9 ± .6	2.332 ± .232	149.1 ± 3.8	1.739 ± .151		
79.2 ± .6	2.329 ± .222	152.8 ± 4.1	1.739 ± .151		
80.5 ± .6	2.305 ± .188	156.7 ± 4.1	1.739 ± .151		
81.8 ± .6	2.121 ± .206	160.4 ± 4.1	1.739 ± .151		
83.1 ± .6	2.305 ± .209	165.1 ± 4.1	1.739 ± .151		
84.4 ± .6	2.328 ± .221	169.5 ± 4.1	1.739 ± .151		
85.7 ± .6	2.121 ± .188	174.1 ± 4.1	1.739 ± .151		
87.0 ± .6	2.305 ± .203	179.0 ± 4.1	1.739 ± .151		
88.3 ± .6	2.328 ± .191	183.7 ± 4.1	1.739 ± .151		
89.6 ± .6	2.121 ± .188	188.3 ± 4.1	1.739 ± .151		
90.9 ± .6	2.305 ± .193	194.9 ± 4.1	1.739 ± .151		
92.2 ± .6	2.327 ± .191	199.7 ± 4.1	1.739 ± .151		
93.5 ± .6	2.121 ± .188	205.4 ± 4.1	1.739 ± .151		
94.8 ± .6	2.305 ± .193	211.1 ± 4.1	1.739 ± .151		
96.1 ± .6	2.327 ± .191	216.8 ± 4.1	1.739 ± .151		
97.4 ± .6	2.121 ± .188	222.5 ± 4.1	1.739 ± .151		
98.7 ± .6	2.305 ± .193	228.2 ± 4.1	1.739 ± .151		
100.0 ± .6	2.327 ± .191	234.7 ± 4.1	1.739 ± .151		
101.3 ± .6	2.121 ± .188	240.4 ± 4.1	1.739 ± .151		
102.6 ± .6	2.305 ± .193	246.1 ± 4.1	1.739 ± .151		
103.9 ± .6	2.327 ± .191	251.8 ± 4.1	1.739 ± .151		
105.2 ± .6	2.121 ± .188	257.5 ± 4.1	1.739 ± .151		
106.5 ± .6	2.305 ± .193	263.2 ± 4.1	1.739 ± .151		
107.8 ± .6	2.327 ± .191	268.9 ± 4.1	1.739 ± .151		
109.1 ± .6	2.121 ± .188	274.6 ± 4.1	1.739 ± .151		
110.4 ± .6	2.305 ± .193	280.3 ± 4.1	1.739 ± .151		
111.7 ± .6	2.327 ± .191	286.0 ± 4.1	1.739 ± .151		
113.0 ± .6	2.121 ± .188	291.7 ± 4.1	1.739 ± .151		
114.3 ± .6	2.305 ± .193	297.4 ± 4.1	1.739 ± .151		
115.6 ± .6	2.327 ± .191	303.1 ± 4.1	1.739 ± .151		
116.9 ± .6	2.121 ± .188	308.8 ± 4.1	1.739 ± .151		
118.2 ± .6	2.305 ± .193	314.5 ± 4.1	1.739 ± .151		
119.5 ± .6	2.327 ± .191	320.2 ± 4.1	1.739 ± .151		
120.8 ± .6	2.121 ± .188	325.9 ± 4.1	1.739 ± .151		
122.1 ± .6	2.305 ± .193	331.6 ± 4.1	1.739 ± .151		
123.4 ± .6	2.327 ± .191	337.3 ± 4.1	1.739 ± .151		
124.7 ± .6	2.121 ± .188	343.0 ± 4.1	1.739 ± .151		
126.0 ± .6	2.305 ± .193	348.7 ± 4.1	1.739 ± .151		
127.3 ± .6	2.327 ± .191	354.4 ± 4.1	1.739 ± .151		
128.6 ± .6	2.121 ± .188	360.1 ± 4.1	1.739 ± .151		
129.9 ± .6	2.305 ± .193	365.8 ± 4.1	1.739 ± .151		
131.2 ± .6	2.327 ± .191	371.5 ± 4.1	1.739 ± .151		
132.5 ± .6	2.121 ± .188	377.2 ± 4.1	1.739 ± .151		
133.8 ± .6	2.305 ± .193	382.9 ± 4.1	1.739 ± .151		
135.1 ± .6	2.327 ± .191	388.6 ± 4.1	1.739 ± .151		
136.4 ± .6	2.121 ± .188	394.3 ± 4.1	1.739 ± .151		
137.7 ± .6	2.305 ± .193	400.0 ± 4.1	1.739 ± .151		
139.0 ± .6	2.327 ± .191	405.7 ± 4.1	1.739 ± .151		
140.3 ± .6	2.121 ± .188	411.4 ± 4.1	1.739 ± .151		
141.6 ± .6	2.305 ± .193	417.1 ± 4.1	1.739 ± .151		
142.9 ± .6	2.327 ± .191	422.8 ± 4.1	1.739 ± .151		
144.2 ± .6	2.121 ± .188	428.5 ± 4.1	1.739 ± .151		
145.5 ± .6	2.305 ± .193	434.2 ± 4.1	1.739 ± .151		
146.8 ± .6	2.327 ± .191	439.9 ± 4.1	1.739 ± .151		
148.1 ± .6	2.121 ± .188	445.6 ± 4.1	1.739 ± .151		
149.4 ± .6	2.305 ± .193	451.3 ± 4.1	1.739 ± .151		
150.7 ± .6	2.327 ± .191	457.0 ± 4.1	1.739 ± .151		
152.0 ± .6	2.121 ± .188	462.7 ± 4.1	1.739 ± .151		
153.3 ± .6	2.305 ± .193	468.4 ± 4.1	1.739 ± .151		
154.6 ± .6	2.327 ± .191	474.1 ± 4.1	1.739 ± .151		
155.9 ± .6	2.121 ± .188	479.8 ± 4.1	1.739 ± .151		
157.2 ± .6	2.305 ± .193	485.5 ± 4.1	1.739 ± .151		
158.5 ± .6	2.327 ± .191	491.2 ± 4.1	1.739 ± .151		
159.8 ± .6	2.121 ± .188	496.9 ± 4.1	1.739 ± .151		
161.1 ± .6	2.305 ± .193	502.6 ± 4.1	1.739 ± .151		
162.4 ± .6	2.327 ± .191	508.3 ± 4.1	1.739 ± .151		
163.7 ± .6	2.121 ± .188	514.0 ± 4.1	1.739 ± .151		
165.0 ± .6	2.305 ± .193	519.7 ± 4.1	1.739 ± .151		
166.3 ± .6	2.327 ± .191	525.4 ± 4.1	1.739 ± .151		
167.6 ± .6	2.121 ± .188	531.1 ± 4.1	1.739 ± .151		
168.9 ± .6	2.305 ± .193	536.8 ± 4.1	1.739 ± .151		
170.2 ± .6	2.327 ± .191	542.5 ± 4.1	1.739 ± .151		
171.5 ± .6	2.121 ± .188	548.2 ± 4.1	1.739 ± .151		
172.8 ± .6	2.305 ± .193	553.9 ± 4.1	1.739 ± .151		
174.1 ± .6	2.327 ± .191	559.6 ± 4.1	1.739 ± .151		
175.4 ± .6	2.121 ± .188	565.3 ± 4.1	1.739 ± .151		
176.7 ± .6	2.305 ± .193	571.0 ± 4.1	1.739 ± .151		
178.0 ± .6	2.327 ± .191	576.7 ± 4.1	1.739 ± .151		
179.3 ± .6	2.121 ± .188	582.4 ± 4.1	1.739 ± .151		
180.6 ± .6	2.305 ± .193	588.1 ± 4.1	1.739 ± .151		
181.9 ± .6	2.327 ± .191	593.8 ± 4.1	1.739 ± .151		
183.2 ± .6	2.121 ± .188	599.5 ± 4.1	1.739 ± .151		
184.5 ± .6	2.305 ± .193	605.2 ± 4.1	1.739 ± .151		
185.8 ± .6	2.327 ± .191	610.9 ± 4.1	1.739 ± .151		
187.1 ± .6	2.121 ± .188	616.6 ± 4.1	1.739 ± .151		
188.4 ± .6	2.305 ± .193	622.3 ± 4.1	1.739 ± .151		
189.7 ± .6	2.327 ± .191	628.0 ± 4.1	1.739 ± .151		
191.0 ± .6	2.121 ± .188	633.7 ± 4.1	1.739 ± .151		
192.3 ± .6	2.305 ± .193	639.4 ± 4.1	1.739 ± .151		
193.6 ± .6	2.327 ± .191	645.1 ± 4.1	1.739 ± .151		
194.9 ± .6	2.121 ± .188	650.8 ± 4.1	1.739 ± .151		
196.2 ± .6	2.305 ± .193	656.5 ± 4.1	1.739 ± .151		
197.5 ± .6	2.327 ± .191	662.2 ± 4.1	1.739 ± .151		
198.8 ± .6	2.121 ± .188	667.9 ± 4.1	1.739 ± .151		
200.1 ± .6	2.305 ± .193	673.6 ± 4.1	1.739 ± .151		
201.4 ± .6	2.327 ± .191	679.3 ± 4.1	1.739 ± .151		
202.7 ± .6	2.121 ± .188	685.0 ± 4.1	1.739 ± .151		
204.0 ± .6	2.305 ± .193	690.7 ± 4.1	1.739 ± .151		
205.3 ± .6	2.327 ± .191	696.4 ± 4.1	1.739 ± .151		
206.6 ± .6	2.121 ± .188	702.1 ± 4.1	1.739 ± .151		
207.9 ± .6	2.305 ± .193	707.8 ± 4.1	1.739 ± .151		
209.2 ± .6	2.327 ± .191	713.5 ± 4.1	1.739 ± .151		
210.5 ± .6	2.121 ± .188	719.2 ± 4.1	1.739 ± .151		
211.8 ± .6	2.305 ± .193	724.9 ± 4.1	1.739 ± .151		
213.1 ± .6	2.327 ± .191	730.6 ± 4.1	1.739 ± .151		
214.4 ± .6	2.121 ± .188	736.3 ± 4.1	1.739 ± .151		
215.7 ± .6	2.305 ± .193	742.0 ± 4.1	1.739 ± .151		
217.0 ± .6	2.327 ± .191	747.7 ± 4.1	1.739 ± .151		
218.3 ± .6	2.121 ± .188	753.4 ± 4.1	1.739 ± .151		
219.6 ± .6	2.305 ± .193	759.1 ± 4.1	1.739 ± .151		
220.9 ± .6	2.327 ± .191	764.8 ± 4.1	1.739 ± .151		
222.2 ± .6	2.121 ± .188	770.5 ± 4.1	1.739 ± .151		
223.5 ± .6	2.305 ± .193	776.2 ± 4.1	1.739 ± .151		
224.8 ± .6	2.327 ± .191	781.9 ± 4.1	1.739 ± .151		
226.1 ± .6	2.121 ± .188	787.6 ± 4.1	1.739 ± .151		
227.4 ± .6	2.305 ± .193	793.3 ± 4.1	1.739 ± .151		
228.7 ± .6	2.327 ± .191	800.0 ± 4.1	1.739 ± .151		
229.9 ± .6	2.121 ± .188	805.7 ± 4.1	1.739 ± .151		
231.2 ± .6	2.305 ± .193	811.4 ± 4.1	1.739 ± .151		
232.5 ± .6	2.327 ± .191	817.1 ± 4.1	1.739 ± .151		
233.8 ± .6	2.121 ± .188	822.8 ± 4.1	1.739 ± .151		
235.1 ± .6	2.305 ± .193	828.5 ± 4.1	1.739 ± .151		
236.4 ± .6	2.327 ± .191	834.2 ± 4.1	1.739 ± .151		
237.7 ± .6	2.121 ± .188	840.0 ± 4.1	1.739 ± .151		
239.0 ± .6	2.305 ± .193	845.7 ± 4.1	1.739 ± .151		
240.3 ± .6	2.327 ± .191	851.4 ± 4.1	1.739 ± .151		
241.6 ± .6	2.121 ± .188	857.1 ± 4.1	1.739 ± .151		
242.9 ± .6	2.3				

TABLE 17.- Continued

## (b) Angle of scatter of 20°

Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV
48.0 ± .6	4.770 ± .374	33.3 ± 1.7	1.895 ± .157	278.3 ± 10.3	.737 ± .067
48.7 ± .6	2.958 ± .234	35.0 ± 1.8	1.790 ± .153	289.5 ± 10.9	.675 ± .062
49.3 ± .6	3.079 ± .249	36.7 ± 1.9	1.696 ± .143	300.3 ± 11.7	.665 ± .061
50.0 ± .6	2.810 ± .231	38.7 ± 1.9	1.878 ± .166	313.0 ± 12.5	.637 ± .059
50.6 ± .6	2.202 ± .196	40.7 ± 1.9	1.766 ± .157	326.0 ± 13.4	.637 ± .059
51.3 ± .7	2.800 ± .234	42.7 ± 2.0	1.705 ± .151	339.9 ± 14.4	.640 ± .059
52.0 ± .7	1.027 ± .227	44.7 ± 2.0	1.903 ± .168	354.9 ± 15.8	.709 ± .066
52.7 ± .7	1.045 ± .219	46.7 ± 2.0	1.745 ± .165	371.1 ± 16.8	.750 ± .070
53.4 ± .7	1.063 ± .242	48.7 ± 2.1	1.802 ± .161	388.6 ± 18.2	.816 ± .076
54.1 ± .7	1.081 ± .211	50.7 ± 2.1	1.617 ± .143	407.7 ± 19.8	.845 ± .089
54.8 ± .7	1.113 ± .202	52.7 ± 2.1	1.785 ± .158	429.4 ± 21.6	.923 ± .117
55.5 ± .7	1.161 ± .226	54.7 ± 2.1	1.813 ± .159	451.1 ± 23.7	1.617 ± .154
56.2 ± .7	1.180 ± .201	56.7 ± 2.1	1.646 ± .144	476.1 ± 26.2	1.915 ± .165
56.9 ± .7	1.194 ± .194	58.7 ± 2.1	1.535 ± .134	503.6 ± 29.0	1.887 ± .184
57.6 ± .7	1.206 ± .194	60.7 ± 2.1	1.535 ± .136	534.2 ± 32.3	1.338 ± .133
58.3 ± .7	1.227 ± .191	62.7 ± 2.1	1.541 ± .136	568.4 ± 36.2	1.546 ± .133
59.0 ± .7	1.059 ± .196	64.7 ± 2.1	1.541 ± .136	606.9 ± 40.5	.035 ± .010
59.7 ± .7	1.078 ± .183	66.7 ± 2.1	1.506 ± .127	650.5 ± 46.6	.045 ± .005
60.4 ± .7	1.096 ± .181	68.7 ± 2.1	1.455 ± .123	700.4 ± 53.6	.035 ± .004
61.1 ± .7	1.113 ± .181	70.7 ± 2.1	1.422 ± .120		
61.8 ± .7	1.132 ± .181	72.7 ± 2.1	1.415 ± .117		
62.5 ± .7	1.151 ± .181	74.7 ± 2.1	1.384 ± .117		
63.2 ± .7	1.170 ± .181	76.7 ± 2.1	1.443 ± .122		
63.9 ± .7	1.189 ± .181	78.7 ± 2.1	1.383 ± .118		
64.6 ± .7	1.208 ± .181	80.7 ± 2.1	1.349 ± .115		
65.3 ± .7	1.227 ± .181	82.7 ± 2.1	1.306 ± .111		
66.0 ± .7	1.246 ± .181	84.7 ± 2.1	1.293 ± .111		
66.7 ± .7	1.265 ± .181	86.7 ± 2.1	1.222 ± .105		
67.4 ± .7	1.284 ± .181	88.7 ± 2.1	1.191 ± .102		
68.1 ± .7	1.303 ± .181	90.7 ± 2.1	1.036 ± .089		
68.8 ± .7	1.322 ± .181	92.7 ± 2.1	1.076 ± .093		
69.5 ± .7	1.341 ± .181	94.7 ± 2.1	1.119 ± .101		
70.2 ± .7	1.360 ± .181	96.7 ± 2.1	1.083 ± .098		
70.9 ± .7	1.379 ± .181	98.7 ± 2.1	1.048 ± .089		
71.6 ± .7	1.398 ± .181	100.7 ± 2.1	1.086 ± .085		
72.3 ± .7	1.417 ± .181	102.7 ± 2.1	1.050 ± .082		
73.0 ± .7	1.436 ± .181	104.7 ± 2.1	1.088 ± .082		
73.7 ± .7	1.455 ± .181	106.7 ± 2.1	1.042 ± .074		
74.4 ± .7	1.474 ± .181	108.7 ± 2.1	1.076 ± .073		
75.1 ± .7	1.493 ± .181	110.7 ± 2.1	1.038 ± .076		
75.8 ± .7	1.512 ± .181	112.7 ± 2.1	1.011 ± .073		
76.5 ± .7	1.531 ± .181	114.7 ± 2.1	1.055 ± .076		
77.2 ± .7	1.550 ± .181	116.7 ± 2.1	1.024 ± .073		
77.9 ± .7	1.569 ± .181	118.7 ± 2.1	1.062 ± .076		
78.6 ± .7	1.588 ± .181	120.7 ± 2.1	1.031 ± .073		
79.3 ± .7	1.607 ± .181	122.7 ± 2.1	1.004 ± .073		
80.0 ± .7	1.626 ± .181	124.7 ± 2.1	1.042 ± .073		
80.7 ± .7	1.645 ± .181	126.7 ± 2.1	1.016 ± .073		
81.4 ± .7	1.664 ± .181	128.7 ± 2.1	1.082 ± .073		
82.1 ± .7	1.683 ± .181	130.7 ± 2.1	1.055 ± .073		
82.8 ± .7	1.702 ± .181	132.7 ± 2.1	1.028 ± .073		
83.5 ± .7	1.721 ± .181	134.7 ± 2.1	1.096 ± .073		
84.2 ± .7	1.740 ± .181	136.7 ± 2.1	1.069 ± .073		
84.9 ± .7	1.759 ± .181	138.7 ± 2.1	1.042 ± .073		
85.6 ± .7	1.778 ± .181	140.7 ± 2.1	1.015 ± .073		
86.3 ± .7	1.797 ± .181	142.7 ± 2.1	1.088 ± .073		
87.0 ± .7	1.816 ± .181	144.7 ± 2.1	1.061 ± .073		
87.7 ± .7	1.835 ± .181	146.7 ± 2.1	1.034 ± .073		
88.4 ± .7	1.854 ± .181	148.7 ± 2.1	1.007 ± .073		
89.1 ± .7	1.873 ± .181	150.7 ± 2.1	1.079 ± .073		
89.8 ± .7	1.892 ± .181	152.7 ± 2.1	1.052 ± .073		
90.5 ± .7	1.911 ± .181	154.7 ± 2.1	1.025 ± .073		
91.2 ± .7	1.930 ± .181	156.7 ± 2.1	1.098 ± .073		
91.9 ± .7	1.949 ± .181	158.7 ± 2.1	1.071 ± .073		
92.6 ± .7	1.968 ± .181	160.7 ± 2.1	1.044 ± .073		
93.3 ± .7	1.987 ± .181	162.7 ± 2.1	1.017 ± .073		
94.0 ± .7	2.006 ± .181	164.7 ± 2.1	1.089 ± .073		
94.7 ± .7	2.025 ± .181	166.7 ± 2.1	1.062 ± .073		
95.4 ± .7	2.044 ± .181	168.7 ± 2.1	1.035 ± .073		
96.1 ± .7	2.063 ± .181	170.7 ± 2.1	1.008 ± .073		
96.8 ± .7	2.082 ± .181	172.7 ± 2.1	1.081 ± .073		
97.5 ± .7	2.101 ± .181	174.7 ± 2.1	1.054 ± .073		
98.2 ± .7	2.120 ± .181	176.7 ± 2.1	1.027 ± .073		
98.9 ± .7	2.139 ± .181	178.7 ± 2.1	1.000 ± .073		
99.6 ± .7	2.158 ± .181	180.7 ± 2.1	1.073 ± .073		
100.3 ± .7	2.177 ± .181	182.7 ± 2.1	1.046 ± .073		
101.0 ± .7	2.196 ± .181	184.7 ± 2.1	1.019 ± .073		
101.7 ± .7	2.215 ± .181	186.7 ± 2.1	1.092 ± .073		
102.4 ± .7	2.234 ± .181	188.7 ± 2.1	1.065 ± .073		
103.1 ± .7	2.253 ± .181	190.7 ± 2.1	1.038 ± .073		
103.8 ± .7	2.272 ± .181	192.7 ± 2.1	1.011 ± .073		
104.5 ± .7	2.291 ± .181	194.7 ± 2.1	1.084 ± .073		
105.2 ± .7	2.310 ± .181	196.7 ± 2.1	1.057 ± .073		
105.9 ± .7	2.329 ± .181	198.7 ± 2.1	1.030 ± .073		
106.6 ± .7	2.348 ± .181	200.7 ± 2.1	1.003 ± .073		
107.3 ± .7	2.367 ± .181	202.7 ± 2.1	1.076 ± .073		
108.0 ± .7	2.386 ± .181	204.7 ± 2.1	1.049 ± .073		
108.7 ± .7	2.405 ± .181	206.7 ± 2.1	1.022 ± .073		
109.4 ± .7	2.424 ± .181	208.7 ± 2.1	1.095 ± .073		
110.1 ± .7	2.443 ± .181	210.7 ± 2.1	1.068 ± .073		
110.8 ± .7	2.462 ± .181	212.7 ± 2.1	1.041 ± .073		
111.5 ± .7	2.481 ± .181	214.7 ± 2.1	1.014 ± .073		
112.2 ± .7	2.500 ± .181	216.7 ± 2.1	1.087 ± .073		
112.9 ± .7	2.519 ± .181	218.7 ± 2.1	1.060 ± .073		
113.6 ± .7	2.538 ± .181	220.7 ± 2.1	1.033 ± .073		
114.3 ± .7	2.557 ± .181	222.7 ± 2.1	1.006 ± .073		
115.0 ± .7	2.576 ± .181	224.7 ± 2.1	1.079 ± .073		
115.7 ± .7	2.595 ± .181	226.7 ± 2.1	1.052 ± .073		
116.4 ± .7	2.614 ± .181	228.7 ± 2.1	1.025 ± .073		
117.1 ± .7	2.633 ± .181	230.7 ± 2.1	1.098 ± .073		
117.8 ± .7	2.652 ± .181	232.7 ± 2.1	1.071 ± .073		
118.5 ± .7	2.671 ± .181	234.7 ± 2.1	1.044 ± .073		
119.2 ± .7	2.690 ± .181	236.7 ± 2.1	1.017 ± .073		
119.9 ± .7	2.709 ± .181	238.7 ± 2.1	1.090 ± .073		
120.6 ± .7	2.728 ± .181	240.7 ± 2.1	1.063 ± .073		
121.3 ± .7	2.747 ± .181	242.7 ± 2.1	1.036 ± .073		
122.0 ± .7	2.766 ± .181	244.7 ± 2.1	1.109 ± .073		
122.7 ± .7	2.785 ± .181	246.7 ± 2.1	1.082 ± .073		
123.4 ± .7	2.804 ± .181	248.7 ± 2.1	1.055 ± .073		
124.1 ± .7	2.823 ± .181	250.7 ± 2.1	1.028 ± .073		
124.8 ± .7	2.842 ± .181	252.7 ± 2.1	1.001 ± .073		
125.5 ± .7	2.861 ± .181	254.7 ± 2.1	1.074 ± .073		
126.2 ± .7	2.880 ± .181	256.7 ± 2.1	1.057 ± .073		
126.9 ± .7	2.899 ± .181	258.7 ± 2.1	1.030 ± .073		
127.6 ± .7	2.918 ± .181	260.7 ± 2.1	1.003 ± .073		
128.3 ± .7	2.937 ± .181	262.7 ± 2.1	1.076 ± .073		
129.0 ± .7	2.956 ± .181	264.7 ± 2.1	1.029 ± .073		
129.7 ± .7	2.975 ± .181	266.7 ± 2.1	1.052 ± .073		
130.4 ± .7	2.994 ± .181	268.7 ± 2.1	1.025 ± .073		
131.1 ± .7	3.013 ± .181	270.7 ± 2.1	1.098 ± .073		
131.8 ± .7	3.032 ± .181	272.7 ± 2.1	1.071 ± .073		
132.5 ± .7	3.051 ± .181	274.7 ± 2.1	1.044 ± .073		
133.2 ± .7	3.070 ± .181	276.7 ± 2.1	1.017 ± .073		
133.9 ± .7	3.089 ± .181	278.7 ± 2.1	1.090 ± .073		
134.6 ± .7	3.108 ± .181	280.7 ± 2.1	1.063 ± .073		
135.3 ± .7	3.127 ± .181	282.7 ± 2.1	1.036 ± .073		
136.0 ± .7	3.146 ± .181	284.7 ± 2.1	1.109 ± .073		
136.7 ± .7	3.165 ± .181	286.7 ± 2.1	1.082 ± .073		
137.4 ± .7	3.184 ± .181	288.7 ± 2.1	1.055 ± .073		
138.1 ± .7	3.203 ± .181	290.7 ± 2.1	1.028 ± .073		
138.8 ± .7	3.222 ± .181	292.7 ± 2.1	1.001 ± .073		
139.5 ± .7	3.241 ± .181	294.7 ± 2.1	1.074 ± .073		
140.2 ± .7	3.260 ± .181	296.7 ± 2.1	1.044 ± .073		
140.9 ± .7	3.279 ± .181	298.7 ± 2.1	1.017 ± .073		
141.6 ± .7	3.298 ± .181	300.7 ± 2.1	1.090 ± .073		
142.3 ± .7	3.317 ± .181	302.7 ± 2.1	1.063 ± .073		
143.0 ± .7	3.336 ± .181	304.7 ± 2.1	1.036 ± .073		
143.7 ± .7	3.355 ± .181	306.7 ± 2.1	1.109 ± .073		
144.4 ± .7	3.374 ± .181	308.7 ± 2.1	1.082 ± .073		
145.1 ± .7	3.393 ± .181	310.7 ± 2.1	1.055 ± .073		
145.8 ± .7	3.412 ± .181	312.7 ± 2.1	1.028 ± .073		
146.5 ± .7	3.431 ± .181	314.7 ± 2.1	1.001 ± .073		
147.2 ± .7	3.450 ± .181	316.7 ± 2.1	1.074 ± .073		
147.9 ± .7	3.469 ± .181	318.7 ± 2.1	1.044 ± .073		
148.6 ± .7	3.488 ± .181	320.7 ± 2.1	1.117 ± .073		
149.3 ± .7	3.507 ± .181	322.7 ± 2.1	1.080 ± .073		
150.0 ± .7	3.526 ± .181	324.7 ± 2.1	1.053 ± .073		
150.7 ± .7	3.545 ± .181	326.7 ± 2.1	1.026 ± .073		
151.4 ± .7	3.564 ± .181	328.7 ± 2.1	1.099 ± .073		
152.1 ± .7	3.583 ± .181	330.7 ± 2.1	1.062 ± .073		
152.8 ± .7	3.602 ± .181	332.7 ± 2.1	1.035 ± .073		
153.5 ± .7	3.621 ± .181	334.7 ± 2.1	1.108 ± .073		
154.2 ±					

TABLE 17.- Continued  
(e) Angle of scatter of  $30^\circ$

Energy, MeV	Cross section, mb/sr-MeV							
48.4	3.503	.274	94.1	1.7	1.539	.137	283.6	$\pm 10.5$
49.0	2.821	.224	95.9	1.8	1.475	.131	294.5	$\pm 11.2$
49.6	2.633	.213	97.8	1.8	1.434	.127	306.2	$\pm 12.0$
50.2	2.591	.214	99.7	1.9	1.368	.121	318.6	$\pm 12.9$
50.8	2.267	.189	101.6	2.0	1.387	.122	332.4	$\pm 13.8$
51.4	2.208	.186	103.6	2.1	1.386	.122	346.4	$\pm 14.9$
52.0	2.214	.187	105.7	2.1	1.349	.119	361.3	$\pm 16.1$
52.6	2.200	.188	107.9	2.1	1.379	.117	378.6	$\pm 17.4$
53.2	2.194	.170	110.9	2.1	1.286	.114	396.8	$\pm 18.9$
53.8	2.194	.170	112.4	2.1	1.294	.115	416.5	$\pm 20.6$
54.4	2.194	.169	114.8	2.1	1.285	.114	438.1	$\pm 22.5$
55.0	2.194	.170	117.2	2.1	1.259	.111	461.7	$\pm 24.7$
55.6	2.194	.170	119.8	2.1	1.221	.107	487.7	$\pm 27.3$
56.2	2.194	.170	122.4	2.1	1.212	.106	516.5	$\pm 30.3$
56.8	2.194	.170	125.1	2.1	1.163	.102	548.6	$\pm 33.9$
57.4	2.194	.169	127.9	2.1	1.126	.099	584.5	$\pm 38.1$
58.0	2.194	.169	130.9	2.1	1.083	.091	625.1	$\pm 43.2$
58.6	2.194	.167	133.9	2.1	1.057	.085	671.2	$\pm 49.4$
59.2	2.194	.167	137.0	2.1	1.020	.086	-	-
59.8	2.194	.167	140.1	2.1	1.052	.081	-	-
60.4	2.194	.167	143.7	2.1	1.020	.086	-	-
61.0	2.194	.167	147.2	2.1	1.009	.086	-	-
61.6	2.194	.167	150.9	2.1	1.009	.086	-	-
62.2	2.194	.167	154.6	2.1	1.009	.086	-	-
62.8	2.194	.167	158.6	2.1	1.009	.086	-	-
63.4	2.194	.167	162.8	2.1	1.009	.086	-	-
64.0	2.194	.167	167.1	2.1	1.009	.086	-	-
64.6	2.194	.167	171.6	2.1	1.009	.086	-	-
65.2	2.194	.167	176.3	2.1	1.009	.086	-	-
65.8	2.194	.167	181.2	2.1	1.009	.086	-	-
66.4	2.194	.167	186.4	2.1	1.009	.086	-	-
67.0	2.194	.167	191.7	2.1	1.009	.086	-	-
67.6	2.194	.167	197.1	2.1	1.009	.086	-	-
68.2	2.194	.167	203.3	2.1	1.009	.086	-	-
68.8	2.194	.167	209.5	2.1	1.009	.086	-	-
69.4	2.194	.167	216.1	2.1	1.009	.086	-	-
70.0	2.194	.167	223.0	2.1	1.009	.086	-	-
70.6	2.194	.167	230.2	2.1	1.009	.086	-	-
71.2	2.194	.167	237.9	2.1	1.009	.086	-	-
71.8	2.194	.167	246.0	2.1	1.009	.086	-	-
72.4	2.194	.167	254.6	2.1	1.009	.086	-	-
73.0	2.194	.167	263.7	2.1	1.009	.086	-	-
73.6	2.194	.167	273.3	2.1	1.009	.086	-	-

TABLE 17.- Concluded

(f) Angle of scatter of  $60^\circ$ 

Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV
1.6	.000	34.1	.1.7	111.9	283.6 $\pm$ 10.5
1.6	.226	95.9	.1.8	110.9	294.5 $\pm$ 11.2
1.6	.202	97.8	.1.8	1.222	306.2 $\pm$ 12.0
1.6	.185	99.7	.1.9	1.328	318.6 $\pm$ 12.9
1.6	.192	101.6	.1.9	1.236	332.0 $\pm$ 13.8
1.6	.173	103.6	.1.9	1.171	346.4 $\pm$ 14.9
1.6	.171	105.7	.1.9	1.182	361.3 $\pm$ 16.1
1.6	.174	107.9	.1.9	1.151	378.6 $\pm$ 17.4
1.6	.156	110.1	.1.9	1.157	396.8 $\pm$ 18.9
1.6	.157	112.4	.1.9	1.140	416.5 $\pm$ 20.6
1.6	.149	114.7	.1.9	1.108	438.1 $\pm$ 22.5
1.6	.142	117.2	.1.9	1.098	461.7 $\pm$ 24.7
1.6	.150	120.4	.1.9	1.072	487.7 $\pm$ 27.3
1.6	.142	122.4	.1.9	1.040	516.5 $\pm$ 30.3
1.6	.133	125.1	.1.9	1.001	548.6 $\pm$ 33.9
1.6	.156	127.9	.1.9	1.974	584.5 $\pm$ 38.1
1.6	.164	130.9	.1.9	1.946	625.1 $\pm$ 43.2
1.6	.164	133.3	.1.9	1.949	671.2 $\pm$ 49.4
1.6	.164	135.5	.1.9	1.949	.000
1.6	.155	137.0	.1.9	1.949	.000
1.6	.155	140.3	.1.9	1.949	.000
1.6	.155	143.7	.1.9	1.949	.000
1.6	.155	147.2	.1.9	1.949	.000
1.6	.155	150.7	.1.9	1.949	.000
1.6	.154	154.1	.1.9	1.949	.000
1.6	.146	158.0	.1.9	1.949	.000
1.6	.155	162.8	.1.9	1.949	.000
1.6	.150	167.1	.1.9	1.949	.000
1.6	.145	171.6	.1.9	1.949	.000
1.6	.141	176.3	.1.9	1.949	.000
1.6	.133	181.2	.1.9	1.949	.000
1.6	.141	186.1	.1.9	1.949	.000
1.6	.133	191.7	.1.9	1.949	.000
1.6	.133	197.4	.1.9	1.949	.000
1.6	.135	203.3	.1.9	1.949	.000
1.6	.135	209.1	.1.9	1.949	.000
1.6	.131	216.1	.1.9	1.949	.000
1.6	.129	223.0	.1.9	1.949	.000
1.6	.130	230.7	.1.9	1.949	.000
1.6	.124	239.7	.1.9	1.949	.000
1.6	.123	246.0	.1.9	1.949	.000
1.6	.122	254.6	.1.9	1.949	.000
1.6	.120	263.7	.1.9	1.949	.000
1.6	.122	273.3	.1.9	1.949	.000
1.6	.119	283.6	.1.9	1.949	.000
1.6	.119	294.5	.1.9	1.949	.000
1.6	.119	306.2	.1.9	1.949	.000
1.6	.119	318.6	.1.9	1.949	.000
1.6	.119	332.0	.1.9	1.949	.000
1.6	.119	346.4	.1.9	1.949	.000
1.6	.119	361.3	.1.9	1.949	.000
1.6	.119	378.6	.1.9	1.949	.000
1.6	.119	396.8	.1.9	1.949	.000
1.6	.119	416.5	.1.9	1.949	.000
1.6	.119	438.1	.1.9	1.949	.000
1.6	.119	461.7	.1.9	1.949	.000
1.6	.119	487.7	.1.9	1.949	.000
1.6	.119	516.5	.1.9	1.949	.000
1.6	.119	548.6	.1.9	1.949	.000
1.6	.119	584.5	.1.9	1.949	.000
1.6	.119	625.1	.1.9	1.949	.000
1.6	.119	671.2	.1.9	1.949	.000
1.6	.119	717.4	.1.9	1.949	.000
1.6	.119	767.8	.1.9	1.949	.000
1.6	.119	80.1	.1.9	1.949	.000
1.6	.119	84.9	.1.9	1.949	.000
1.6	.119	88.7	.1.9	1.949	.000
1.6	.119	92.4	.1.9	1.949	.000

TABLE 18.- DOUBLE DIFFERENTIAL CROSS SECTIONS FOR PRODUCTION OF  
SECONDARY DEUTERONS FROM BERYLLIUM TARGET, 2.35 g/cm<sup>2</sup> THICK

[Incident proton energy, 558 MeV]

(a) Angle of scatter of 10°

Energy, MeV	Cross section, μb/sr-MeV	Energy, MeV	Cross section, μb/sr-MeV
88.8 ± 1.1	0.0 ± 0.0	167.0 ± 2.9	68.0 ± 1.6
89.0 ± 0.8	17.0 ± 1.1	173.1 ± 2.4	33.0 ± 1.1
90.0 ± 0.8	14.1 ± 1.2	176.5 ± 2.5	33.0 ± 1.1
91.0 ± 0.8	11.9 ± 1.2	182.0 ± 2.8	33.0 ± 1.1
92.0 ± 0.8	10.8 ± 1.2	186.5 ± 3.0	33.0 ± 1.1
93.0 ± 0.8	10.7 ± 1.2	189.0 ± 3.0	33.0 ± 1.1
94.0 ± 0.8	10.7 ± 1.2	193.0 ± 3.0	33.0 ± 1.1
95.0 ± 0.8	10.7 ± 1.2	197.0 ± 3.0	33.0 ± 1.1
96.0 ± 0.8	10.7 ± 1.2	201.0 ± 3.0	33.0 ± 1.1
97.0 ± 0.8	10.7 ± 1.2	205.0 ± 3.0	33.0 ± 1.1
98.0 ± 0.8	10.7 ± 1.2	209.0 ± 3.0	33.0 ± 1.1
99.0 ± 0.8	10.7 ± 1.2	213.0 ± 3.0	33.0 ± 1.1
100.0 ± 0.8	10.7 ± 1.2	217.0 ± 3.0	33.0 ± 1.1
101.0 ± 0.8	10.7 ± 1.2	221.0 ± 3.0	33.0 ± 1.1
102.0 ± 0.8	10.7 ± 1.2	225.0 ± 3.0	33.0 ± 1.1
103.0 ± 0.8	10.7 ± 1.2	229.0 ± 3.0	33.0 ± 1.1
104.0 ± 0.8	10.7 ± 1.2	233.0 ± 3.0	33.0 ± 1.1
105.0 ± 0.8	10.7 ± 1.2	237.0 ± 3.0	33.0 ± 1.1
106.0 ± 0.8	10.7 ± 1.2	241.0 ± 3.0	33.0 ± 1.1
107.0 ± 0.8	10.7 ± 1.2	245.0 ± 3.0	33.0 ± 1.1
108.0 ± 0.8	10.7 ± 1.2	249.0 ± 3.0	33.0 ± 1.1
109.0 ± 0.8	10.7 ± 1.2	253.0 ± 3.0	33.0 ± 1.1
110.0 ± 0.8	10.7 ± 1.2	257.0 ± 3.0	33.0 ± 1.1
111.0 ± 0.8	10.7 ± 1.2	261.0 ± 3.0	33.0 ± 1.1
112.0 ± 0.8	10.7 ± 1.2	265.0 ± 3.0	33.0 ± 1.1
113.0 ± 0.8	10.7 ± 1.2	269.0 ± 3.0	33.0 ± 1.1
114.0 ± 0.8	10.7 ± 1.2	273.0 ± 3.0	33.0 ± 1.1
115.0 ± 0.8	10.7 ± 1.2	277.0 ± 3.0	33.0 ± 1.1
116.0 ± 0.8	10.7 ± 1.2	281.0 ± 3.0	33.0 ± 1.1
117.0 ± 0.8	10.7 ± 1.2	285.0 ± 3.0	33.0 ± 1.1
118.0 ± 0.8	10.7 ± 1.2	289.0 ± 3.0	33.0 ± 1.1
119.0 ± 0.8	10.7 ± 1.2	293.0 ± 3.0	33.0 ± 1.1
120.0 ± 0.8	10.7 ± 1.2	297.0 ± 3.0	33.0 ± 1.1
121.0 ± 0.8	10.7 ± 1.2	301.0 ± 3.0	33.0 ± 1.1
122.0 ± 0.8	10.7 ± 1.2	305.0 ± 3.0	33.0 ± 1.1
123.0 ± 0.8	10.7 ± 1.2	309.0 ± 3.0	33.0 ± 1.1
124.0 ± 0.8	10.7 ± 1.2	313.0 ± 3.0	33.0 ± 1.1
125.0 ± 0.8	10.7 ± 1.2	317.0 ± 3.0	33.0 ± 1.1
126.0 ± 0.8	10.7 ± 1.2	321.0 ± 3.0	33.0 ± 1.1
127.0 ± 0.8	10.7 ± 1.2	325.0 ± 3.0	33.0 ± 1.1
128.0 ± 0.8	10.7 ± 1.2	329.0 ± 3.0	33.0 ± 1.1
129.0 ± 0.8	10.7 ± 1.2	333.0 ± 3.0	33.0 ± 1.1
130.0 ± 0.8	10.7 ± 1.2	337.0 ± 3.0	33.0 ± 1.1
131.0 ± 0.8	10.7 ± 1.2	341.0 ± 3.0	33.0 ± 1.1
132.0 ± 0.8	10.7 ± 1.2	345.0 ± 3.0	33.0 ± 1.1
133.0 ± 0.8	10.7 ± 1.2	349.0 ± 3.0	33.0 ± 1.1
134.0 ± 0.8	10.7 ± 1.2	353.0 ± 3.0	33.0 ± 1.1
135.0 ± 0.8	10.7 ± 1.2	357.0 ± 3.0	33.0 ± 1.1
136.0 ± 0.8	10.7 ± 1.2	361.0 ± 3.0	33.0 ± 1.1
137.0 ± 0.8	10.7 ± 1.2	365.0 ± 3.0	33.0 ± 1.1
138.0 ± 0.8	10.7 ± 1.2	369.0 ± 3.0	33.0 ± 1.1
139.0 ± 0.8	10.7 ± 1.2	373.0 ± 3.0	33.0 ± 1.1
140.0 ± 0.8	10.7 ± 1.2	377.0 ± 3.0	33.0 ± 1.1
141.0 ± 0.8	10.7 ± 1.2	381.0 ± 3.0	33.0 ± 1.1
142.0 ± 0.8	10.7 ± 1.2	385.0 ± 3.0	33.0 ± 1.1
143.0 ± 0.8	10.7 ± 1.2	389.0 ± 3.0	33.0 ± 1.1
144.0 ± 0.8	10.7 ± 1.2	393.0 ± 3.0	33.0 ± 1.1
145.0 ± 0.8	10.7 ± 1.2	397.0 ± 3.0	33.0 ± 1.1
146.0 ± 0.8	10.7 ± 1.2	401.0 ± 3.0	33.0 ± 1.1
147.0 ± 0.8	10.7 ± 1.2	405.0 ± 3.0	33.0 ± 1.1
148.0 ± 0.8	10.7 ± 1.2	409.0 ± 3.0	33.0 ± 1.1
149.0 ± 0.8	10.7 ± 1.2	413.0 ± 3.0	33.0 ± 1.1
150.0 ± 0.8	10.7 ± 1.2	417.0 ± 3.0	33.0 ± 1.1
151.0 ± 0.8	10.7 ± 1.2	421.0 ± 3.0	33.0 ± 1.1
152.0 ± 0.8	10.7 ± 1.2	425.0 ± 3.0	33.0 ± 1.1
153.0 ± 0.8	10.7 ± 1.2	429.0 ± 3.0	33.0 ± 1.1
154.0 ± 0.8	10.7 ± 1.2	433.0 ± 3.0	33.0 ± 1.1
155.0 ± 0.8	10.7 ± 1.2	437.0 ± 3.0	33.0 ± 1.1
156.0 ± 0.8	10.7 ± 1.2	441.0 ± 3.0	33.0 ± 1.1
157.0 ± 0.8	10.7 ± 1.2	445.0 ± 3.0	33.0 ± 1.1
158.0 ± 0.8	10.7 ± 1.2	449.0 ± 3.0	33.0 ± 1.1
159.0 ± 0.8	10.7 ± 1.2	453.0 ± 3.0	33.0 ± 1.1
160.0 ± 0.8	10.7 ± 1.2	457.0 ± 3.0	33.0 ± 1.1
161.0 ± 0.8	10.7 ± 1.2	461.0 ± 3.0	33.0 ± 1.1

TABLE 18.- Continued

(b) Angle of scatter of  $20^\circ$ 

Energy, MeV	Cross section, $\mu\text{b}/\text{sr}\cdot\text{MeV}$	Energy, MeV	Cross section, $\mu\text{b}/\text{sr}\cdot\text{MeV}$
108.4	1.7	109.5	1.7
111.3	0.6	113.0	0.7
114.6	0.3	116.1	0.3
118.1	0.1	120.7	0.1
121.2	0.0	123.5	0.0
125.1	-0.1	128.0	-0.1
129.0	-0.3	132.1	-0.3
135.1	-0.6	137.1	-0.6
139.1	-0.9	143.6	-0.9
148.1	-1.3	153.1	-1.3
153.1	-1.6	158.1	-1.6
161.1	-1.9	167.1	-1.9
164.1	-2.2	170.1	-2.2
173.1	-2.5	176.1	-2.5
183.1	-2.8	186.1	-2.8
190.1	-3.1	193.1	-3.1
197.1	-3.4	205.1	-3.4
213.1	-3.7	218.1	-3.7

TABLE 18. - Continued

TABLE 18. - Continued

Energy, MeV	Cross section, $\mu\text{b}/\text{sr-MeV}$
1.0	9.0 ± 1.0
1.5	8.4 ± 0.5
2.0	8.3 ± 0.5
2.5	8.9 ± 0.7
3.0	7.7 ± 0.7
3.5	7.4 ± 0.7
4.0	7.0 ± 0.7
4.5	6.6 ± 0.7
5.0	6.3 ± 0.7
5.5	6.0 ± 0.7
6.0	5.7 ± 0.7
6.5	5.4 ± 0.7
7.0	5.1 ± 0.7
7.5	4.8 ± 0.7
8.0	4.5 ± 0.7
8.5	4.2 ± 0.7
9.0	3.9 ± 0.7
9.5	3.6 ± 0.7
10.0	3.3 ± 0.7
10.5	3.0 ± 0.7
11.0	2.7 ± 0.7
11.5	2.4 ± 0.7
12.0	2.1 ± 0.7
12.5	1.8 ± 0.7
13.0	1.5 ± 0.7
13.5	1.2 ± 0.7
14.0	1.0 ± 0.7
14.5	0.8 ± 0.7
15.0	0.6 ± 0.7
15.5	0.4 ± 0.7
16.0	0.2 ± 0.7
16.5	0.1 ± 0.7
17.0	0.0 ± 0.7
17.5	0.0 ± 0.7
18.0	0.0 ± 0.7
18.5	0.0 ± 0.7
19.0	0.0 ± 0.7
19.5	0.0 ± 0.7
20.0	0.0 ± 0.7
20.5	0.0 ± 0.7
21.0	0.0 ± 0.7
21.5	0.0 ± 0.7
22.0	0.0 ± 0.7
22.5	0.0 ± 0.7
23.0	0.0 ± 0.7
23.5	0.0 ± 0.7
24.0	0.0 ± 0.7
24.5	0.0 ± 0.7
25.0	0.0 ± 0.7
25.5	0.0 ± 0.7
26.0	0.0 ± 0.7
26.5	0.0 ± 0.7
27.0	0.0 ± 0.7
27.5	0.0 ± 0.7
28.0	0.0 ± 0.7
28.5	0.0 ± 0.7
29.0	0.0 ± 0.7
29.5	0.0 ± 0.7
30.0	0.0 ± 0.7
30.5	0.0 ± 0.7
31.0	0.0 ± 0.7
31.5	0.0 ± 0.7
32.0	0.0 ± 0.7
32.5	0.0 ± 0.7
33.0	0.0 ± 0.7
33.5	0.0 ± 0.7
34.0	0.0 ± 0.7
34.5	0.0 ± 0.7
35.0	0.0 ± 0.7
35.5	0.0 ± 0.7
36.0	0.0 ± 0.7
36.5	0.0 ± 0.7
37.0	0.0 ± 0.7
37.5	0.0 ± 0.7
38.0	0.0 ± 0.7
38.5	0.0 ± 0.7
39.0	0.0 ± 0.7
39.5	0.0 ± 0.7
40.0	0.0 ± 0.7
40.5	0.0 ± 0.7
41.0	0.0 ± 0.7
41.5	0.0 ± 0.7
42.0	0.0 ± 0.7
42.5	0.0 ± 0.7
43.0	0.0 ± 0.7
43.5	0.0 ± 0.7
44.0	0.0 ± 0.7
44.5	0.0 ± 0.7
45.0	0.0 ± 0.7
45.5	0.0 ± 0.7
46.0	0.0 ± 0.7
46.5	0.0 ± 0.7
47.0	0.0 ± 0.7
47.5	0.0 ± 0.7
48.0	0.0 ± 0.7
48.5	0.0 ± 0.7
49.0	0.0 ± 0.7
49.5	0.0 ± 0.7
50.0	0.0 ± 0.7
50.5	0.0 ± 0.7
51.0	0.0 ± 0.7
51.5	0.0 ± 0.7
52.0	0.0 ± 0.7
52.5	0.0 ± 0.7
53.0	0.0 ± 0.7
53.5	0.0 ± 0.7
54.0	0.0 ± 0.7
54.5	0.0 ± 0.7
55.0	0.0 ± 0.7
55.5	0.0 ± 0.7
56.0	0.0 ± 0.7
56.5	0.0 ± 0.7
57.0	0.0 ± 0.7
57.5	0.0 ± 0.7
58.0	0.0 ± 0.7
58.5	0.0 ± 0.7
59.0	0.0 ± 0.7
59.5	0.0 ± 0.7
60.0	0.0 ± 0.7
60.5	0.0 ± 0.7
61.0	0.0 ± 0.7
61.5	0.0 ± 0.7
62.0	0.0 ± 0.7
62.5	0.0 ± 0.7
63.0	0.0 ± 0.7
63.5	0.0 ± 0.7
64.0	0.0 ± 0.7
64.5	0.0 ± 0.7
65.0	0.0 ± 0.7
65.5	0.0 ± 0.7
66.0	0.0 ± 0.7
66.5	0.0 ± 0.7
67.0	0.0 ± 0.7
67.5	0.0 ± 0.7
68.0	0.0 ± 0.7
68.5	0.0 ± 0.7
69.0	0.0 ± 0.7
69.5	0.0 ± 0.7
70.0	0.0 ± 0.7
70.5	0.0 ± 0.7
71.0	0.0 ± 0.7
71.5	0.0 ± 0.7
72.0	0.0 ± 0.7
72.5	0.0 ± 0.7
73.0	0.0 ± 0.7
73.5	0.0 ± 0.7
74.0	0.0 ± 0.7
74.5	0.0 ± 0.7
75.0	0.0 ± 0.7
75.5	0.0 ± 0.7
76.0	0.0 ± 0.7
76.5	0.0 ± 0.7
77.0	0.0 ± 0.7
77.5	0.0 ± 0.7
78.0	0.0 ± 0.7
78.5	0.0 ± 0.7
79.0	0.0 ± 0.7
79.5	0.0 ± 0.7
80.0	0.0 ± 0.7
80.5	0.0 ± 0.7
81.0	0.0 ± 0.7
81.5	0.0 ± 0.7
82.0	0.0 ± 0.7
82.5	0.0 ± 0.7
83.0	0.0 ± 0.7
83.5	0.0 ± 0.7
84.0	0.0 ± 0.7
84.5	0.0 ± 0.7
85.0	0.0 ± 0.7
85.5	0.0 ± 0.7
86.0	0.0 ± 0.7
86.5	0.0 ± 0.7
87.0	0.0 ± 0.7
87.5	0.0 ± 0.7
88.0	0.0 ± 0.7
88.5	0.0 ± 0.7
89.0	0.0 ± 0.7
89.5	0.0 ± 0.7
90.0	0.0 ± 0.7
90.5	0.0 ± 0.7
91.0	0.0 ± 0.7
91.5	0.0 ± 0.7
92.0	0.0 ± 0.7
92.5	0.0 ± 0.7
93.0	0.0 ± 0.7
93.5	0.0 ± 0.7
94.0	0.0 ± 0.7
94.5	0.0 ± 0.7
95.0	0.0 ± 0.7
95.5	0.0 ± 0.7
96.0	0.0 ± 0.7
96.5	0.0 ± 0.7
97.0	0.0 ± 0.7
97.5	0.0 ± 0.7
98.0	0.0 ± 0.7
98.5	0.0 ± 0.7
99.0	0.0 ± 0.7
99.5	0.0 ± 0.7
100.0	0.0 ± 0.7

TABLE 18.- Concluded

TABLE 19. - DOUBLE DIFFERENTIAL CROSS SECTIONS FOR PRODUCTION OF  
SECONDARY DEUTERONS FROM CARBON TARGET, 0.95 g/cm<sup>2</sup> THICK

[Incident proton energy, 558 MeV]

TABLE 19.- Continued  
(b) Angle of scatter of  $20^\circ$

Energy, MeV	Cross section, $\mu\text{b}/\text{sr-MeV}$	Energy, MeV	Cross section, $\mu\text{b}/\text{sr-MeV}$
9.0	5.7	38.7	32.9
23.0	2.9	93.1	22.9
47.4	1.3	170.3	17.6
67.0	0.5	179.6	18.3
89.1	0.1	195.9	19.6
101.4	0.05	205.9	20.5
105.0	0.07	213.8	21.8
109.7	0.09	220.2	22.0
114.5	0.11	228.7	22.8
119.3	0.13	239.1	23.9
124.1	0.15	249.5	24.9
128.9	0.17	259.9	25.9
133.7	0.19	269.3	26.9
138.5	0.21	278.7	27.8
143.3	0.23	288.1	28.9
148.1	0.25	297.5	29.7
152.9	0.27	306.9	30.6
157.7	0.29	316.3	31.6
162.5	0.31	325.7	32.5
167.3	0.33	335.1	33.5
172.1	0.35	344.5	34.4
176.9	0.37	353.9	35.3
181.7	0.39	363.3	36.3
186.5	0.41	372.7	37.2
191.3	0.43	382.1	38.2
196.1	0.45	391.5	39.1
200.9	0.47	399.9	39.9
205.7	0.49	409.3	40.9
210.5	0.51	418.7	41.8
215.3	0.53	428.1	42.8
220.1	0.55	437.5	43.7
224.9	0.57	446.9	44.6
229.7	0.59	456.3	45.6
234.5	0.61	465.7	46.5
239.3	0.63	475.1	47.5
244.1	0.65	484.5	48.4
248.9	0.67	493.9	49.3
253.7	0.69	503.3	50.3
258.5	0.71	512.7	51.2
263.3	0.73	522.1	52.1
268.1	0.75	531.5	53.1
272.9	0.77	540.9	54.0
277.7	0.79	550.3	55.0
282.5	0.81	559.7	55.9
287.3	0.83	569.1	56.9
292.1	0.85	578.5	57.8
296.9	0.87	587.9	58.7
301.7	0.89	597.3	59.7
306.5	0.91	606.7	60.6
311.3	0.93	616.1	61.6
316.1	0.95	625.5	62.5
320.9	0.97	634.9	63.4
325.7	0.99	644.3	64.3
330.5	1.01	653.7	65.3
335.3	1.03	663.1	66.3
340.1	1.05	672.5	67.2
344.9	1.07	681.9	68.1
349.7	1.09	691.3	69.1
354.5	1.11	700.7	70.0
359.3	1.13	709.1	70.9
364.1	1.15	718.5	71.8
368.9	1.17	727.9	72.7
373.7	1.19	737.3	73.7
378.5	1.21	746.7	74.6
383.3	1.23	756.1	75.6
388.1	1.25	765.5	76.5
392.9	1.27	774.9	77.4
397.7	1.29	784.3	78.4
402.5	1.31	793.7	79.3
407.3	1.33	803.1	80.3
412.1	1.35	812.5	81.2
416.9	1.37	821.9	82.1
421.7	1.39	831.3	83.1
426.5	1.41	840.7	84.0
431.3	1.43	849.1	84.9
436.1	1.45	858.5	85.8
440.9	1.47	867.9	86.7
445.7	1.49	877.3	87.7
450.5	1.51	886.7	88.6
455.3	1.53	896.1	89.6
459.1	1.55	905.5	90.5
463.9	1.57	914.9	91.4
468.7	1.59	924.3	92.4
473.5	1.61	933.7	93.3
478.3	1.63	943.1	94.3
482.1	1.65	952.5	95.2
486.9	1.67	961.9	96.1
490.7	1.69	971.3	97.1
494.5	1.71	980.7	98.0
498.3	1.73	989.1	98.9
502.1	1.75	998.5	99.8
505.9	1.77	1007.9	100.7
509.7	1.79	1017.3	101.7
513.5	1.81	1026.7	102.6
517.3	1.83	1036.1	103.6
521.1	1.85	1045.5	104.5
524.9	1.87	1054.9	105.4
528.7	1.89	1064.3	106.4
532.5	1.91	1073.7	107.3
536.3	1.93	1083.1	108.3
540.1	1.95	1092.5	109.2
543.9	1.97	1101.9	110.1
547.7	1.99	1111.3	111.1
551.5	2.01	1120.7	112.0
555.3	2.03	1129.1	112.9
559.1	2.05	1138.5	113.8
562.9	2.07	1147.9	114.7
566.7	2.09	1157.3	115.7
570.5	2.11	1166.7	116.6
574.3	2.13	1176.1	117.6
578.1	2.15	1185.5	118.5
581.9	2.17	1194.9	119.4
585.7	2.19	1204.3	120.4
589.5	2.21	1213.7	121.3
593.3	2.23	1223.1	122.3
597.1	2.25	1232.5	123.2
600.9	2.27	1241.9	124.1
604.7	2.29	1251.3	125.1
608.5	2.31	1260.7	126.0
612.3	2.33	1269.1	126.9
616.1	2.35	1278.5	127.8
620.9	2.37	1287.9	128.7
624.7	2.39	1297.3	129.7
628.5	2.41	1306.7	130.6
632.3	2.43	1316.1	131.6
636.1	2.45	1325.5	132.5
640.9	2.47	1334.9	133.4
644.7	2.49	1344.3	134.3
648.5	2.51	1353.7	135.3
652.3	2.53	1363.1	136.3
656.1	2.55	1372.5	137.2
660.9	2.57	1381.9	138.1
664.7	2.59	1391.3	139.1
668.5	2.61	1400.7	140.0
672.3	2.63	1409.1	140.9
676.1	2.65	1418.5	141.8
680.9	2.67	1427.9	142.7
684.7	2.69	1437.3	143.7
688.5	2.71	1446.7	144.6
692.3	2.73	1456.1	145.6
696.1	2.75	1465.5	146.5
700.9	2.77	1474.9	147.4
704.7	2.79	1484.3	148.4
708.5	2.81	1493.7	149.3
712.3	2.83	1503.1	150.3
716.1	2.85	1512.5	151.2
720.9	2.87	1521.9	152.1
724.7	2.89	1531.3	153.1
728.5	2.91	1540.7	154.0
732.3	2.93	1549.1	154.9
736.1	2.95	1558.5	155.8
740.9	2.97	1567.9	156.7
744.7	2.99	1577.3	157.7
748.5	3.01	1586.7	158.6
752.3	3.03	1596.1	159.6
756.1	3.05	1605.5	160.5
760.9	3.07	1614.9	161.4
764.7	3.09	1624.3	162.3
768.5	3.11	1633.7	163.3
772.3	3.13	1643.1	164.3
776.1	3.15	1652.5	165.2
780.9	3.17	1661.9	166.1
784.7	3.19	1671.3	167.1
788.5	3.21	1680.7	168.0
792.3	3.23	1689.1	168.9
796.1	3.25	1698.5	169.8
800.9	3.27	1707.9	170.7
804.7	3.29	1717.3	171.7
808.5	3.31	1726.7	172.6
812.3	3.33	1736.1	173.6
816.1	3.35	1745.5	174.5
820.9	3.37	1754.9	175.4
824.7	3.39	1764.3	176.3
828.5	3.41	1773.7	177.3
832.3	3.43	1783.1	178.3
836.1	3.45	1792.5	179.2
840.9	3.47	1801.9	180.1
844.7	3.49	1811.3	181.1
848.5	3.51	1820.7	182.0
852.3	3.53	1829.1	182.9
856.1	3.55	1838.5	183.8
860.9	3.57	1847.9	184.7
864.7	3.59	1857.3	185.7
868.5	3.61	1866.7	186.6
872.3	3.63	1876.1	187.6
876.1	3.65	1885.5	188.5
880.9	3.67	1894.9	189.4
884.7	3.69	1904.3	190.4
888.5	3.71	1913.7	191.3
892.3	3.73	1923.1	192.3
896.1	3.75	1932.5	193.2
900.9	3.77	1941.9	194.1
904.7	3.79	1951.3	195.1
908.5	3.81	1960.7	196.0
912.3	3.83	1969.1	196.9
916.1	3.85	1978.5	197.8
920.9	3.87	1987.9	198.7
924.7	3.89	1997.3	199.7
928.5	3.91	2006.7	200.6
932.3	3.93	2016.1	201.6
936.1	3.95	2025.5	202.5
940.9	3.97	2034.9	203.4
944.7	3.99	2044.3	204.3
948.5	4.01	2053.7	205.3
952.3	4.03	2063.1	206.3
956.1	4.05	2072.5	207.2
960.9	4.07	2081.9	208.1
964.7	4.09	2091.3	209.1
968.5	4.11	2100.7	210.0
972.3	4.13	2109.1	210.9
976.1	4.15	2118.5	211.8
980.9	4.17	2127.9	212.7
984.7	4.19	2137.3	213.7
988.5	4.21	2146.7	214.6
992.3	4.23	2156.1	215.6
996.1	4.25	2165.5	216.5
1000.9	4.27	2174.9	217.4
1004.7	4.29	2184.3	218.3
1008.5	4.31	2193.7	219.3
1012.3	4.33	2203.1	220.3
1016.1	4.35	2212.5	221.2
1020.9	4.37	2221.9	222.0
1024.7	4.39	2231.3	223.1
1028.5	4.41	2240.7	224.0
1032.3	4.43	2249.1	224.9
1036.1	4.45	2258.5	225.8
1040.9	4.47	2267.9	226.7
1044.7	4.49	2277.3	227.7
1048.5	4.51	2286.7	228.6
1052.3	4.53	2295.1	229.5
1056.1	4.55	2304.5	230.4
1060.9	4.57	2313.9	231.3
1064.7	4.59	2323.3	232.3
1068.5	4.61	2332.7	233.2
1072.3	4.63	2342.1	234.2
1076.1	4.65	2351.5	235.1
1080.9	4.67	2360.9	236.0
1084.7	4.69	2369.3	236.9
1088.5	4.71	2378.7	237.8
1092.3	4.73	2388.1	238.8
1096.1	4.75	2397.5	239.7
1100.9	4.77	2406.9	240.6
1104.7	4.79	2416.3	241.6
1108.5	4.81	2425.7	242.5
1112.3	4.83	2435.1	243.3
1116.1	4.85	2444.5	244.4
1120.9	4.87	2453.9	245.3
1124.7	4.89	2463.3	246.3
1128.5	4.91	2472.7	247.2
1132.3	4.93	2482.1	248.2
1136.1	4.95	2491.5	249.1
1140.9	4.97	2500.9	250.0
1144.7	4.99	2	

TABLE 19.- Continued

TABLE 19.- Continued

(d) Angle of scatter of  $40^\circ$ 

Energy, MeV	Cross section, $\mu\text{b}/\text{sr-MeV}$	Energy, MeV	Cross section, $\mu\text{b}/\text{sr-MeV}$
89.1	1.1	1.2	1.1
90	1.1	1.2	1.1
91	1.1	1.2	1.1
92	1.1	1.2	1.1
93	1.1	1.2	1.1
94	1.1	1.2	1.1
95	1.1	1.2	1.1
96	1.1	1.2	1.1
97	1.1	1.2	1.1
98	1.1	1.2	1.1
99	1.1	1.2	1.1
100	1.1	1.2	1.1
101	1.1	1.2	1.1
102	1.1	1.2	1.1
103	1.1	1.2	1.1
104	1.1	1.2	1.1
105	1.1	1.2	1.1
106	1.1	1.2	1.1
107	1.1	1.2	1.1
108	1.1	1.2	1.1
109	1.1	1.2	1.1
110	1.1	1.2	1.1
111	1.1	1.2	1.1
112	1.1	1.2	1.1
113	1.1	1.2	1.1
114	1.1	1.2	1.1
115	1.1	1.2	1.1
116	1.1	1.2	1.1
117	1.1	1.2	1.1
118	1.1	1.2	1.1
119	1.1	1.2	1.1
120	1.1	1.2	1.1
121	1.1	1.2	1.1
122	1.1	1.2	1.1
123	1.1	1.2	1.1
124	1.1	1.2	1.1
125	1.1	1.2	1.1
126	1.1	1.2	1.1
127	1.1	1.2	1.1
128	1.1	1.2	1.1
129	1.1	1.2	1.1
130	1.1	1.2	1.1
131	1.1	1.2	1.1
132	1.1	1.2	1.1
133	1.1	1.2	1.1
134	1.1	1.2	1.1
135	1.1	1.2	1.1
136	1.1	1.2	1.1
137	1.1	1.2	1.1
138	1.1	1.2	1.1
139	1.1	1.2	1.1
140	1.1	1.2	1.1
141	1.1	1.2	1.1
142	1.1	1.2	1.1
143	1.1	1.2	1.1
144	1.1	1.2	1.1
145	1.1	1.2	1.1
146	1.1	1.2	1.1
147	1.1	1.2	1.1
148	1.1	1.2	1.1
149	1.1	1.2	1.1
150	1.1	1.2	1.1
151	1.1	1.2	1.1
152	1.1	1.2	1.1
153	1.1	1.2	1.1
154	1.1	1.2	1.1
155	1.1	1.2	1.1
156	1.1	1.2	1.1
157	1.1	1.2	1.1
158	1.1	1.2	1.1
159	1.1	1.2	1.1
160	1.1	1.2	1.1
161	1.1	1.2	1.1
162	1.1	1.2	1.1
163	1.1	1.2	1.1
164	1.1	1.2	1.1
165	1.1	1.2	1.1
166	1.1	1.2	1.1
167	1.1	1.2	1.1
168	1.1	1.2	1.1
169	1.1	1.2	1.1
170	1.1	1.2	1.1
171	1.1	1.2	1.1
172	1.1	1.2	1.1
173	1.1	1.2	1.1
174	1.1	1.2	1.1
175	1.1	1.2	1.1
176	1.1	1.2	1.1
177	1.1	1.2	1.1
178	1.1	1.2	1.1
179	1.1	1.2	1.1
180	1.1	1.2	1.1
181	1.1	1.2	1.1
182	1.1	1.2	1.1
183	1.1	1.2	1.1
184	1.1	1.2	1.1
185	1.1	1.2	1.1
186	1.1	1.2	1.1
187	1.1	1.2	1.1
188	1.1	1.2	1.1
189	1.1	1.2	1.1
190	1.1	1.2	1.1
191	1.1	1.2	1.1
192	1.1	1.2	1.1
193	1.1	1.2	1.1
194	1.1	1.2	1.1
195	1.1	1.2	1.1
196	1.1	1.2	1.1
197	1.1	1.2	1.1
198	1.1	1.2	1.1
199	1.1	1.2	1.1
200	1.1	1.2	1.1
201	1.1	1.2	1.1
202	1.1	1.2	1.1
203	1.1	1.2	1.1
204	1.1	1.2	1.1
205	1.1	1.2	1.1
206	1.1	1.2	1.1
207	1.1	1.2	1.1
208	1.1	1.2	1.1
209	1.1	1.2	1.1
210	1.1	1.2	1.1
211	1.1	1.2	1.1
212	1.1	1.2	1.1
213	1.1	1.2	1.1
214	1.1	1.2	1.1
215	1.1	1.2	1.1
216	1.1	1.2	1.1
217	1.1	1.2	1.1
218	1.1	1.2	1.1
219	1.1	1.2	1.1
220	1.1	1.2	1.1
221	1.1	1.2	1.1
222	1.1	1.2	1.1
223	1.1	1.2	1.1
224	1.1	1.2	1.1
225	1.1	1.2	1.1
226	1.1	1.2	1.1
227	1.1	1.2	1.1
228	1.1	1.2	1.1
229	1.1	1.2	1.1
230	1.1	1.2	1.1
231	1.1	1.2	1.1
232	1.1	1.2	1.1
233	1.1	1.2	1.1
234	1.1	1.2	1.1
235	1.1	1.2	1.1
236	1.1	1.2	1.1
237	1.1	1.2	1.1
238	1.1	1.2	1.1
239	1.1	1.2	1.1

TABLE 19.- Continued  
(e) Angle of scatter of  $50^{\circ}$

Energy, MeV	Cross section, $\mu\text{b}/\text{sr-MeV}$	Energy, MeV	Cross section, $\mu\text{b}/\text{sr-MeV}$
89.7	1.7	13.0	1.7
90.8	1.7	13.9	1.7
103.6	1.7	14.0	1.7
106.0	1.7	14.9	1.7
107.0	1.7	15.0	1.7
118.0	1.7	15.8	1.7
122.4	1.7	16.0	1.7
126.9	1.7	16.8	1.7
130.2	1.7	17.3	1.7
133.7	1.7	17.9	1.7
142.1	1.7	18.2	1.7
145.2	1.7	18.7	1.7
154.7	1.7	19.2	1.7
160.0	1.7	19.7	1.7
165.0	1.7	20.0	1.7

0.8	2.9	13.0	1.7
1.7	3.0	13.9	1.7
1.7	3.3	14.0	1.7
1.7	3.3	14.9	1.7
1.7	3.3	15.0	1.7
1.7	3.3	15.8	1.7
1.7	3.3	16.0	1.7
1.7	3.3	16.8	1.7
1.7	3.3	17.3	1.7
1.7	3.3	17.9	1.7
1.7	3.3	18.2	1.7
1.7	3.3	18.7	1.7
1.7	3.3	19.2	1.7
1.7	3.3	19.7	1.7
1.7	3.3	20.0	1.7

168	8	207	1.7
174	8	211	1.7
178	1.4	215	1.7
184	1.8	219	1.7
191	1.9	220	1.7
195	1.9	229	1.7
199	1.9	239	1.7
203	1.9	240	1.7
207	1.9	255	1.7
211	1.9	261	1.7
215	1.9	267	1.7
219	1.9	274	1.7
224	1.9	280	1.7
239	1.9	287	1.7
240	1.9	309	1.7
255	1.9	317	1.7
261	1.9	325	1.7
267	1.9	333	1.7
274	1.9	356	1.7
280	1.9	362	1.7
287	1.9	384	1.7
309	1.9	419	1.7
317	1.9	432	1.7
325	1.9	446	1.7
333	1.9	452	1.7
356	1.9	464	1.7
362	1.9	474	1.7
384	1.9	486	1.7
419	1.9	496	1.7
432	1.9	506	1.7
446	1.9	516	1.7
452	1.9	526	1.7
464	1.9	536	1.7
474	1.9	546	1.7
486	1.9	556	1.7
496	1.9	566	1.7
506	1.9	576	1.7
516	1.9	586	1.7
526	1.9	596	1.7
536	1.9	606	1.7
546	1.9	616	1.7
556	1.9	626	1.7
566	1.9	636	1.7
576	1.9	646	1.7
586	1.9	656	1.7
596	1.9	666	1.7
606	1.9	676	1.7
616	1.9	686	1.7
626	1.9	696	1.7
636	1.9	706	1.7
646	1.9	716	1.7
656	1.9	726	1.7
666	1.9	736	1.7
676	1.9	746	1.7
686	1.9	756	1.7
696	1.9	766	1.7
706	1.9	776	1.7
716	1.9	786	1.7
726	1.9	796	1.7
736	1.9	806	1.7
746	1.9	816	1.7
756	1.9	826	1.7
766	1.9	836	1.7
776	1.9	846	1.7
786	1.9	856	1.7
796	1.9	866	1.7
806	1.9	876	1.7
816	1.9	886	1.7
826	1.9	896	1.7
836	1.9	906	1.7
846	1.9	916	1.7
856	1.9	926	1.7
866	1.9	936	1.7
876	1.9	946	1.7
886	1.9	956	1.7
896	1.9	966	1.7
906	1.9	976	1.7
916	1.9	986	1.7
926	1.9	996	1.7
936	1.9	1006	1.7
946	1.9	1016	1.7
956	1.9	1026	1.7
966	1.9	1036	1.7
976	1.9	1046	1.7
986	1.9	1056	1.7
996	1.9	1066	1.7
1006	1.9	1076	1.7
1016	1.9	1086	1.7
1026	1.9	1096	1.7
1036	1.9	1106	1.7
1046	1.9	1116	1.7
1056	1.9	1126	1.7
1066	1.9	1136	1.7
1076	1.9	1146	1.7
1086	1.9	1156	1.7
1096	1.9	1166	1.7
1106	1.9	1176	1.7
1116	1.9	1186	1.7
1126	1.9	1196	1.7
1136	1.9	1206	1.7
1146	1.9	1216	1.7
1156	1.9	1226	1.7
1166	1.9	1236	1.7
1176	1.9	1246	1.7
1186	1.9	1256	1.7
1196	1.9	1266	1.7
1206	1.9	1276	1.7
1216	1.9	1286	1.7
1226	1.9	1296	1.7
1236	1.9	1306	1.7
1246	1.9	1316	1.7
1256	1.9	1326	1.7
1266	1.9	1336	1.7
1276	1.9	1346	1.7
1286	1.9	1356	1.7
1296	1.9	1366	1.7
1306	1.9	1376	1.7
1316	1.9	1386	1.7
1326	1.9	1396	1.7
1336	1.9	1406	1.7
1346	1.9	1416	1.7
1356	1.9	1426	1.7
1366	1.9	1436	1.7
1376	1.9	1446	1.7
1386	1.9	1456	1.7
1396	1.9	1466	1.7
1406	1.9	1476	1.7
1416	1.9	1486	1.7
1426	1.9	1496	1.7
1436	1.9	1506	1.7
1446	1.9	1516	1.7
1456	1.9	1526	1.7
1466	1.9	1536	1.7
1476	1.9	1546	1.7
1486	1.9	1556	1.7
1496	1.9	1566	1.7
1506	1.9	1576	1.7
1516	1.9	1586	1.7
1526	1.9	1596	1.7
1536	1.9	1606	1.7
1546	1.9	1616	1.7
1556	1.9	1626	1.7
1566	1.9	1636	1.7
1576	1.9	1646	1.7
1586	1.9	1656	1.7
1596	1.9	1666	1.7
1606	1.9	1676	1.7
1616	1.9	1686	1.7
1626	1.9	1696	1.7
1636	1.9	1706	1.7
1646	1.9	1716	1.7
1656	1.9	1726	1.7
1666	1.9	1736	1.7
1676	1.9	1746	1.7
1686	1.9	1756	1.7
1696	1.9	1766	1.7
1706	1.9	1776	1.7
1716	1.9	1786	1.7
1726	1.9	1796	1.7
1736	1.9	1806	1.7
1746	1.9	1816	1.7
1756	1.9	1826	1.7
1766	1.9	1836	1.7
1776	1.9	1846	1.7
1786	1.9	1856	1.7
1796	1.9	1866	1.7
1806	1.9	1876	1.7
1816	1.9	1886	1.7
1826	1.9	1896	1.7
1836	1.9	1906	1.7
1846	1.9	1916	1.7
1856	1.9	1926	1.7
1866	1.9	1936	1.7
1876	1.9	1946	1.7
1886	1.9	1956	1.7
1896	1.9	1966	1.7
1906	1.9	1976	1.7
1916	1.9	1986	1.7
1926	1.9	1996	1.7
1936	1.9	2006	1.7
1946	1.9	2016	1.7
1956	1.9	2026	1.7
1966	1.9	2036	1.7
1976	1.9	2046	1.7
1986	1.9	2056	1.7
1996	1.9	2066	1.7
2006	1.9	2076	1.7
2016	1.9	2086	1.7
2026	1.9	2096	1.7
2036	1.9	2106	1.7
2046	1.9	2116	1.7
2056	1.9	2126	1.7
2066	1.9	2136	1.7
2076	1.9	2146	1.7
2086	1.9	2156	1.7
2096	1.9	2166	1.7
2106	1.9	2176	1.7
2116	1.9	2186	1.7
2126	1.9	2196	1.7
2136	1.9	2206	1.7
2146	1.9	2216	1.7
2156	1.9	2226	1.7
2166	1.9	2236	1.7
2176	1.9	2246	1.7
2186	1.9	2256	1.7
2196	1.9	2266	1.7
2206	1.9	2276	1.7
2216	1.9	2286	1.7
2226	1.9	2296	1.7
2236	1.9	2306	1.7
2246	1.9	2316	1.7
2256	1.9	2326	1.7
2266	1.9	2336	1.7
2276	1.9	2346	1.7
2286	1.9	2356	1.7
2296	1.9	2366	1.7
2306	1.9	2376	1.7
2316	1.9	2386	1.7
2326	1.9	2396	1.7
2336	1.9	2406	1.7
2346	1.9	2416	1.7
2356	1.9	2426	1.7
2366	1.9	2436	1.7
2376	1.9	2446	1.7
2386	1.9	2456	1.7
2396	1.9	2466	1.7
2406	1.9	2476	1.7
2416	1.9	2486	1.7
2426	1.9	2496	1.7
2436	1.9	2506	1.7
2446	1.9	2516	1.7
2456	1.9	2526	1.7
2466	1.9	2536	1.7
2476	1.9	2546	1.7
2486	1.9	2556	1.7
2496	1.9	2566	1.7
2506	1.9	2576	1.7
2516	1.9	2586	1.7
2526	1.9	2596	1.7
2536	1.9	2606	1.7
2546	1.9	2616	1.7
2556	1.9	2626	1.7
2566	1.9	2636	1.7
2576	1.9	2646	1.7
2586	1.9	2656	1.7
2596	1.9	2666	1.7
2606	1.9	2676	1.7
2616	1.9	2686	1.7
2626	1.9	2696	1.7
2636	1.9	2706	1.7
2646	1.9		

TABLE 19.- Concluded

(f) Angle of scatter of  $60^\circ$ 

Energy, MeV	Cross section, $\mu\text{b}/\text{sr-MeV}$	Energy, MeV	Cross section, $\mu\text{b}/\text{sr-MeV}$
8.0	8.8	6.3	8.8
8.8	7.0	7.0	7.0
9.1	7.2	7.1	7.1
10.2	7.1	7.1	7.1
11.1	7.3	7.3	7.3
12.2	7.3	7.3	7.3
13.3	7.3	7.3	7.3
14.4	7.3	7.3	7.3
15.5	7.3	7.3	7.3
16.6	7.3	7.3	7.3
17.7	7.3	7.3	7.3
18.8	7.3	7.3	7.3
19.9	7.3	7.3	7.3
20.0	7.3	7.3	7.3
20.7	7.3	7.3	7.3
21.5	7.3	7.3	7.3
22.2	7.3	7.3	7.3
22.9	7.3	7.3	7.3
23.9	7.3	7.3	7.3
24.5	7.3	7.3	7.3
25.0	7.3	7.3	7.3
25.5	7.3	7.3	7.3
26.1	7.3	7.3	7.3
26.7	7.3	7.3	7.3
27.4	7.3	7.3	7.3
28.0	7.3	7.3	7.3
28.7	7.3	7.3	7.3
29.3	7.3	7.3	7.3
30.9	7.3	7.3	7.3
31.7	7.3	7.3	7.3
32.5	7.3	7.3	7.3
33.4	7.3	7.3	7.3
34.3	7.3	7.3	7.3
35.2	7.3	7.3	7.3
36.2	7.3	7.3	7.3
37.2	7.3	7.3	7.3
38.3	7.3	7.3	7.3
41.9	7.3	7.3	7.3
43.2	7.3	7.3	7.3
45.5	7.3	7.3	7.3
48.8	7.3	7.3	7.3
52.2	7.3	7.3	7.3
56.6	7.3	7.3	7.3
61.0	7.3	7.3	7.3
66.4	7.3	7.3	7.3
71.8	7.3	7.3	7.3
77.2	7.3	7.3	7.3
82.6	7.3	7.3	7.3
88.0	7.3	7.3	7.3
93.4	7.3	7.3	7.3
98.8	7.3	7.3	7.3
104.2	7.3	7.3	7.3
109.6	7.3	7.3	7.3
115.0	7.3	7.3	7.3
120.4	7.3	7.3	7.3
125.8	7.3	7.3	7.3
131.2	7.3	7.3	7.3
136.6	7.3	7.3	7.3
142.0	7.3	7.3	7.3
147.4	7.3	7.3	7.3
152.8	7.3	7.3	7.3
158.2	7.3	7.3	7.3
163.6	7.3	7.3	7.3

TABLE 20.- DOUBLE DIFFERENTIAL CROSS SECTIONS FOR PRODUCTION OF  
SECONDARY DEUTERONS FROM ALUMINUM TARGET, 1.82 g/cm<sup>2</sup> THICK

[Incident proton energy, 558 MeV]

(a) Angle of scatter of 10°

Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV
88.8 ± 1.1	.000 ± .000	167.0 ± 2.9	.010 ± .010
89.9 ± 1.0	.241 ± .035	173.1 ± 3.0	.109 ± .011
91.0 ± 1.2	.206 ± .030	176.2 ± 3.1	.010 ± .010
92.5 ± 1.6	.024 ± .024	179.5 ± 3.2	.097 ± .010
95.8 ± 1.3	.018 ± .018	182.8 ± 3.3	.010 ± .009
97.1 ± 1.6	.023 ± .023	186.2 ± 3.4	.009 ± .009
98.3 ± 1.4	.019 ± .019	193.4 ± 3.5	.009 ± .009
99.7 ± 1.4	.019 ± .019	197.2 ± 3.6	.009 ± .009
101.0 ± 1.3	.016 ± .016	201.0 ± 3.7	.009 ± .009
102.3 ± 1.2	.016 ± .016	205.0 ± 3.8	.009 ± .009
103.6 ± 1.1	.016 ± .016	209.2 ± 3.9	.008 ± .008
105.9 ± 1.1	.016 ± .016	213.4 ± 4.0	.008 ± .008
108.2 ± 1.1	.016 ± .016	217.6 ± 4.1	.008 ± .008
110.5 ± 1.1	.015 ± .015	221.8 ± 4.2	.008 ± .008
112.8 ± 1.1	.015 ± .015	226.0 ± 4.3	.008 ± .008
115.1 ± 1.1	.014 ± .014	230.2 ± 4.4	.008 ± .008
117.4 ± 1.1	.014 ± .014	234.4 ± 4.5	.008 ± .008
119.7 ± 1.1	.014 ± .014	238.6 ± 4.6	.008 ± .008
122.0 ± 1.1	.015 ± .015	242.8 ± 4.7	.008 ± .008
124.3 ± 1.1	.015 ± .015	247.0 ± 4.8	.008 ± .008
126.6 ± 1.1	.015 ± .015	251.2 ± 4.9	.008 ± .008
128.9 ± 1.1	.015 ± .015	255.4 ± 5.0	.008 ± .008
131.2 ± 1.1	.015 ± .015	259.6 ± 5.1	.008 ± .008
133.5 ± 1.1	.015 ± .015	263.8 ± 5.2	.008 ± .008
135.8 ± 1.1	.015 ± .015	268.0 ± 5.3	.008 ± .008
138.1 ± 1.1	.015 ± .015	272.2 ± 5.4	.008 ± .008
140.4 ± 1.1	.015 ± .015	276.4 ± 5.5	.008 ± .008
142.7 ± 1.1	.015 ± .015	280.6 ± 5.6	.008 ± .008
145.0 ± 1.1	.015 ± .015	284.8 ± 5.7	.008 ± .008
147.3 ± 1.1	.015 ± .015	289.0 ± 5.8	.008 ± .008
149.6 ± 1.1	.015 ± .015	293.2 ± 5.9	.008 ± .008
151.9 ± 1.1	.015 ± .015	297.4 ± 6.0	.008 ± .008
154.2 ± 1.1	.015 ± .015	301.6 ± 6.1	.008 ± .008
156.5 ± 1.1	.015 ± .015	305.8 ± 6.2	.008 ± .008
158.8 ± 1.1	.015 ± .015	310.0 ± 6.3	.008 ± .008
161.1 ± 1.1	.015 ± .015	314.2 ± 6.4	.008 ± .008
164.4 ± 1.1	.015 ± .015	318.4 ± 6.5	.008 ± .008
166.7 ± 1.1	.015 ± .015	322.6 ± 6.6	.008 ± .008
169.0 ± 1.1	.015 ± .015	326.8 ± 6.7	.008 ± .008
171.3 ± 1.1	.015 ± .015	331.0 ± 6.8	.008 ± .008
173.6 ± 1.1	.015 ± .015	335.2 ± 6.9	.008 ± .008
175.9 ± 1.1	.015 ± .015	339.4 ± 7.0	.008 ± .008
178.2 ± 1.1	.015 ± .015	343.6 ± 7.1	.008 ± .008
180.5 ± 1.1	.015 ± .015	347.8 ± 7.2	.008 ± .008
182.8 ± 1.1	.015 ± .015	352.0 ± 7.3	.008 ± .008
185.1 ± 1.1	.015 ± .015	356.2 ± 7.4	.008 ± .008
187.4 ± 1.1	.015 ± .015	360.4 ± 7.5	.008 ± .008
189.7 ± 1.1	.015 ± .015	364.6 ± 7.6	.008 ± .008
192.0 ± 1.1	.015 ± .015	368.8 ± 7.7	.008 ± .008
194.3 ± 1.1	.015 ± .015	373.0 ± 7.8	.008 ± .008
196.6 ± 1.1	.015 ± .015	377.2 ± 7.9	.008 ± .008
198.9 ± 1.1	.015 ± .015	381.4 ± 8.0	.008 ± .008
201.2 ± 1.1	.015 ± .015	385.6 ± 8.1	.008 ± .008
203.5 ± 1.1	.015 ± .015	389.8 ± 8.2	.008 ± .008
205.8 ± 1.1	.015 ± .015	394.0 ± 8.3	.008 ± .008
208.1 ± 1.1	.015 ± .015	398.2 ± 8.4	.008 ± .008
210.4 ± 1.1	.015 ± .015	402.4 ± 8.5	.008 ± .008
212.7 ± 1.1	.015 ± .015	406.6 ± 8.6	.008 ± .008
215.0 ± 1.1	.015 ± .015	410.8 ± 8.7	.008 ± .008
217.3 ± 1.1	.015 ± .015	415.0 ± 8.8	.008 ± .008
219.6 ± 1.1	.015 ± .015	419.2 ± 8.9	.008 ± .008
221.9 ± 1.1	.015 ± .015	423.4 ± 9.0	.008 ± .008
224.2 ± 1.1	.015 ± .015	427.6 ± 9.1	.008 ± .008
226.5 ± 1.1	.015 ± .015	431.8 ± 9.2	.008 ± .008
228.8 ± 1.1	.015 ± .015	436.0 ± 9.3	.008 ± .008
231.1 ± 1.1	.015 ± .015	440.2 ± 9.4	.008 ± .008
233.4 ± 1.1	.015 ± .015	444.4 ± 9.5	.008 ± .008
235.7 ± 1.1	.015 ± .015	448.6 ± 9.6	.008 ± .008
238.0 ± 1.1	.015 ± .015	452.8 ± 9.7	.008 ± .008
240.3 ± 1.1	.015 ± .015	457.0 ± 9.8	.008 ± .008
242.6 ± 1.1	.015 ± .015	461.2 ± 9.9	.008 ± .008
244.9 ± 1.1	.015 ± .015	465.4 ± 10.0	.008 ± .008
247.2 ± 1.1	.015 ± .015	469.6 ± 10.1	.008 ± .008
249.5 ± 1.1	.015 ± .015	473.8 ± 10.2	.008 ± .008
251.8 ± 1.1	.015 ± .015	478.0 ± 10.3	.008 ± .008
254.1 ± 1.1	.015 ± .015	482.2 ± 10.4	.008 ± .008
256.4 ± 1.1	.015 ± .015	486.4 ± 10.5	.008 ± .008
258.7 ± 1.1	.015 ± .015	490.6 ± 10.6	.008 ± .008
261.0 ± 1.1	.015 ± .015	494.8 ± 10.7	.008 ± .008
263.3 ± 1.1	.015 ± .015	499.0 ± 10.8	.008 ± .008
265.6 ± 1.1	.015 ± .015	503.2 ± 10.9	.008 ± .008
267.9 ± 1.1	.015 ± .015	507.4 ± 11.0	.008 ± .008
270.2 ± 1.1	.015 ± .015	511.6 ± 11.1	.008 ± .008
272.5 ± 1.1	.015 ± .015	515.8 ± 11.2	.008 ± .008
274.8 ± 1.1	.015 ± .015	519.9 ± 11.3	.008 ± .008
277.1 ± 1.1	.015 ± .015	524.1 ± 11.4	.008 ± .008
279.4 ± 1.1	.015 ± .015	528.3 ± 11.5	.008 ± .008
281.7 ± 1.1	.015 ± .015	532.5 ± 11.6	.008 ± .008
284.0 ± 1.1	.015 ± .015	536.7 ± 11.7	.008 ± .008
286.3 ± 1.1	.015 ± .015	540.9 ± 11.8	.008 ± .008
288.6 ± 1.1	.015 ± .015	545.1 ± 11.9	.008 ± .008
290.9 ± 1.1	.015 ± .015	549.3 ± 12.0	.008 ± .008
293.2 ± 1.1	.015 ± .015	553.5 ± 12.1	.008 ± .008
295.5 ± 1.1	.015 ± .015	557.7 ± 12.2	.008 ± .008
297.8 ± 1.1	.015 ± .015	561.9 ± 12.3	.008 ± .008
299.9 ± 1.1	.015 ± .015	566.1 ± 12.4	.008 ± .008
302.2 ± 1.1	.015 ± .015	570.3 ± 12.5	.008 ± .008
304.5 ± 1.1	.015 ± .015	574.5 ± 12.6	.008 ± .008
306.8 ± 1.1	.015 ± .015	578.7 ± 12.7	.008 ± .008
309.1 ± 1.1	.015 ± .015	582.9 ± 12.8	.008 ± .008
311.4 ± 1.1	.015 ± .015	587.1 ± 12.9	.008 ± .008
313.7 ± 1.1	.015 ± .015	591.3 ± 13.0	.008 ± .008
316.0 ± 1.1	.015 ± .015	595.5 ± 13.1	.008 ± .008
318.3 ± 1.1	.015 ± .015	599.7 ± 13.2	.008 ± .008
320.6 ± 1.1	.015 ± .015	603.9 ± 13.3	.008 ± .008
323.9 ± 1.1	.015 ± .015	608.1 ± 13.4	.008 ± .008
326.2 ± 1.1	.015 ± .015	612.3 ± 13.5	.008 ± .008
328.5 ± 1.1	.015 ± .015	616.5 ± 13.6	.008 ± .008
330.8 ± 1.1	.015 ± .015	620.7 ± 13.7	.008 ± .008
333.1 ± 1.1	.015 ± .015	624.9 ± 13.8	.008 ± .008

TABLE 20.- Continued

TABLE 20.- Continued

(c) Angle of scatter of  $30^\circ$ 

Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV
109.9	.552	227.3	.023
111.4	.572	229.7	.023
116.0	.574	234.2	.026
118.6	.577	242.7	.023
119.5	.567	245.3	.020
123.1	.559	271.5	.019
125.3	.571	277.0	.018
125.9	.568	284.0	.016
126.4	.563	295.5	.012
126.8	.569	303.6	.012
129.6	.553	313.6	.009
130.9	.560	319.1	.010
132.9	.567	320.9	.012
135.0	.571	323.0	.012
137.1	.577	329.5	.008
139.3	.581	330.8	.008
141.6	.586	331.3	.006
146.0	.596	333.8	.006
148.0	.602	348.9	.006
151.6	.604	357.9	.006
153.2	.604	367.9	.006
156.0	.605	378.5	.007
158.0	.605	389.7	.007
161.6	.605	401.3	.008
164.5	.605	426.5	.008
167.4	.605	439.7	.008
170.4	.605	453.7	.008
173.4	.605	468.5	.008
176.5	.605	501.2	.009
179.8	.605	518.7	.009
183.5	.605	537.7	.009
186.5	.605	557.0	.009
190.7	.605	601.6	.009
193.7	.605	625.8	.009
197.5	.605	651.8	.009
201.3	.605	679.7	.010
205.3	.605	709.7	.010
209.4	.605	742.1	.010
218.1	.605	777.1	.010
222.6	.605	815.2	.003

TABLE 20.- Continued  
 (d) Angle of scatter of  $40^\circ$

Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV
89.1	.000	2.9	.003
90.2	.000	3.0	.003
91.3	.015	3.1	.003
92.5	.011	3.2	.003
93.7	.009	3.3	.003
94.9	.008	3.4	.003
96.1	.008	3.5	.003
97.4	.008	3.6	.003
98.6	.008	3.7	.003
99.9	.008	3.8	.003
101.2	.008	3.9	.003
102.6	.008	4.0	.003
104.0	.008	4.1	.003
105.5	.008	4.2	.003
106.9	.008	4.3	.003
108.4	.008	4.4	.003
109.9	.008	4.5	.003
111.3	.008	4.6	.003
112.7	.008	4.7	.003
114.1	.008	4.8	.003
115.6	.008	4.9	.003
117.0	.008	5.0	.003
118.5	.008	5.1	.003
119.9	.008	5.2	.003
121.3	.008	5.3	.003
122.7	.008	5.4	.003
124.1	.008	5.5	.003
125.5	.008	5.6	.003
127.0	.008	5.7	.003
128.4	.008	5.8	.003
130.0	.008	5.9	.003
132.5	.008	6.0	.003
134.9	.008	6.1	.003
137.3	.008	6.2	.003
141.7	.008	6.3	.003
143.2	.008	6.4	.003
146.6	.008	6.5	.003
148.1	.008	6.6	.003
151.5	.008	6.7	.003
153.9	.008	6.8	.003
156.3	.008	6.9	.003
158.7	.008	7.0	.003
161.1	.008	7.1	.003

TABLE 20.- Continued  
(e) Angle of scatter of  $50^{\circ}$

Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV
89.7	.000	102.0	.000
90.8	.014	103.0	.007
91.1	.010	104.0	.007
91.6	.009	105.0	.007
92.0	.007	106.0	.007
92.4	.007	107.0	.007
92.7	.007	108.0	.007
93.1	.007	109.0	.007
93.5	.007	110.0	.007
93.7	.007	111.0	.007
94.1	.007	112.0	.007
94.5	.007	113.0	.007
94.7	.007	114.0	.007
95.1	.007	115.0	.007
95.5	.007	116.0	.007
95.7	.007	117.0	.007
96.1	.007	118.0	.007
96.5	.007	119.0	.007
96.7	.007	120.0	.007
97.1	.007	121.0	.007
97.4	.007	122.0	.007
97.7	.007	123.0	.007
98.1	.007	124.0	.007
98.4	.007	125.0	.007
98.7	.007	126.0	.007
99.1	.007	127.0	.007
99.4	.007	128.0	.007
99.7	.007	129.0	.007
100.0	.007	130.0	.007
100.3	.007	131.0	.007
100.6	.007	132.0	.007
100.9	.007	133.0	.007
101.2	.007	134.0	.007
101.5	.007	135.0	.007
101.7	.007	136.0	.007
102.0	.007	137.0	.007
102.3	.007	138.0	.007
102.6	.007	139.0	.007
102.9	.007	140.0	.007
103.2	.007	141.0	.007
103.5	.007	142.0	.007
103.8	.007	143.0	.007
104.1	.007	144.0	.007
104.4	.007	145.0	.007
104.7	.007	146.0	.007
105.0	.007	147.0	.007
105.3	.007	148.0	.007
105.6	.007	149.0	.007
105.9	.007	150.0	.007
106.2	.007	151.0	.007
106.5	.007	152.0	.007
106.8	.007	153.0	.007
107.1	.007	154.0	.007
107.4	.007	155.0	.007
107.7	.007	156.0	.007
108.0	.007	157.0	.007
108.3	.007	158.0	.007
108.6	.007	159.0	.007
108.9	.007	160.0	.007
109.2	.007	161.0	.007
109.5	.007	162.0	.007
109.8	.007	163.0	.007
110.1	.007	164.0	.007
110.4	.007	165.0	.007
110.7	.007	166.0	.007
111.0	.007	167.0	.007
111.3	.007	168.0	.007
111.6	.007	169.0	.007
111.9	.007	170.0	.007
112.2	.007	171.0	.007
112.5	.007	172.0	.007
112.8	.007	173.0	.007
113.1	.007	174.0	.007
113.4	.007	175.0	.007
113.7	.007	176.0	.007
114.0	.007	177.0	.007
114.3	.007	178.0	.007
114.6	.007	179.0	.007
114.9	.007	180.0	.007
115.2	.007	181.0	.007
115.5	.007	182.0	.007
115.8	.007	183.0	.007
116.1	.007	184.0	.007
116.4	.007	185.0	.007
116.7	.007	186.0	.007
117.0	.007	187.0	.007
117.3	.007	188.0	.007
117.6	.007	189.0	.007
117.9	.007	190.0	.007
118.2	.007	191.0	.007
118.5	.007	192.0	.007
118.8	.007	193.0	.007
119.1	.007	194.0	.007
119.4	.007	195.0	.007
119.7	.007	196.0	.007
120.0	.007	197.0	.007
120.3	.007	198.0	.007
120.6	.007	199.0	.007
120.9	.007	200.0	.007
121.2	.007	201.0	.007
121.5	.007	202.0	.007
121.8	.007	203.0	.007
122.1	.007	204.0	.007
122.4	.007	205.0	.007
122.7	.007	206.0	.007
123.0	.007	207.0	.007
123.3	.007	208.0	.007
123.6	.007	209.0	.007
123.9	.007	210.0	.007
124.2	.007	211.0	.007
124.5	.007	212.0	.007
124.8	.007	213.0	.007
125.1	.007	214.0	.007
125.4	.007	215.0	.007
125.7	.007	216.0	.007
126.0	.007	217.0	.007
126.3	.007	218.0	.007
126.6	.007	219.0	.007
126.9	.007	220.0	.007
127.2	.007	221.0	.007
127.5	.007	222.0	.007
127.8	.007	223.0	.007
128.1	.007	224.0	.007
128.4	.007	225.0	.007
128.7	.007	226.0	.007
129.0	.007	227.0	.007
129.3	.007	228.0	.007
129.6	.007	229.0	.007
129.9	.007	230.0	.007
130.2	.007	231.0	.007
130.5	.007	232.0	.007
130.8	.007	233.0	.007
131.1	.007	234.0	.007
131.4	.007	235.0	.007
131.7	.007	236.0	.007
132.0	.007	237.0	.007
132.3	.007	238.0	.007
132.6	.007	239.0	.007
132.9	.007	240.0	.007
133.2	.007	241.0	.007
133.5	.007	242.0	.007
133.8	.007	243.0	.007
134.1	.007	244.0	.007
134.4	.007	245.0	.007
134.7	.007	246.0	.007
135.0	.007	247.0	.007
135.3	.007	248.0	.007
135.6	.007	249.0	.007
135.9	.007	250.0	.007
136.2	.007	251.0	.007
136.5	.007	252.0	.007
136.8	.007	253.0	.007
137.1	.007	254.0	.007
137.4	.007	255.0	.007
137.7	.007	256.0	.007
138.0	.007	257.0	.007
138.3	.007	258.0	.007
138.6	.007	259.0	.007
138.9	.007	260.0	.007
139.2	.007	261.0	.007
139.5	.007	262.0	.007
139.8	.007	263.0	.007
140.1	.007	264.0	.007
140.4	.007	265.0	.007
140.7	.007	266.0	.007
141.0	.007	267.0	.007
141.3	.007	268.0	.007
141.6	.007	269.0	.007
141.9	.007	270.0	.007
142.2	.007	271.0	.007
142.5	.007	272.0	.007
142.8	.007	273.0	.007
143.1	.007	274.0	.007
143.4	.007	275.0	.007
143.7	.007	276.0	.007
144.0	.007	277.0	.007
144.3	.007	278.0	.007
144.6	.007	279.0	.007
144.9	.007	280.0	.007
145.2	.007	281.0	.007
145.5	.007	282.0	.007
145.8	.007	283.0	.007
146.1	.007	284.0	.007
146.4	.007	285.0	.007
146.7	.007	286.0	.007
147.0	.007	287.0	.007
147.3	.007	288.0	.007
147.6	.007	289.0	.007
147.9	.007	290.0	.007
148.2	.007	291.0	.007
148.5	.007	292.0	.007
148.8	.007	293.0	.007
149.1	.007	294.0	.007
149.4	.007	295.0	.007
149.7	.007	296.0	.007
150.0	.007	297.0	.007
150.3	.007	298.0	.007
150.6	.007	299.0	.007
150.9	.007	300.0	.007
151.2	.007	301.0	.007
151.5	.007	302.0	.007
151.8	.007	303.0	.007
152.1	.007	304.0	.007
152.4	.007	305.0	.007
152.7	.007	306.0	.007
153.0	.007	307.0	.007
153.3	.007	308.0	.007
153.6	.007	309.0	.007
153.9	.007	310.0	.007
154.2	.007	311.0	.007
154.5	.007	312.0	.007
154.8	.007	313.0	.007
155.1	.007	314.0	.007
155.4	.007	315.0	.007
155.7	.007	316.0	.007
156.0	.007	317.0	.007
156.3	.007	318.0	.007
156.6	.007	319.0	.007
156.9	.007	320.0	.007
157.2	.007	321.0	.007
157.5	.007	322.0	.007
157.8	.007	323.0	.007
158.1	.007	324.0	.007
158.4	.007	325.0	.007
158.7	.007	326.0	.007
159.0	.007	327.0	.007
159.3	.007	328.0	.007
159.6	.007	329.0	.007
159.9	.007	330.0	.007
160.2	.007	331.0	.007
160.5	.007	332.0	.007
160.8	.007	333.0	.007
161.1	.007	334.0	.007
161.4	.007	335.0	.007
161.7	.007	336.0	.007
162.0	.007	337.0	.007
162.3	.007	338.0	.007
162.6	.007	339.0	.007
162.9	.007	340.0	.007
163.2	.007	341.0	.007
163.5	.007	342.0	.007
163.8	.007	343.0	.007
164.1	.007	344.0	.007
164.4	.007	345.0	.007
164.7	.007	346.0	.007
165.0	.007	347.0	.007
165.3	.007	348.0	.007
165.6	.007	349.0	.007
165.9	.007	350.0	.007
166.2	.007	351.0	.007
166.5	.007	352.0	.007
166.8	.007	353.0	.007
167.1	.007	354.0	.007
167.4	.007	355.0	.007
167.7	.007	356.0	.007
168.0	.007	357.0	.007
168.3	.007	358.0	.007
168.6	.007	359.0	.007
168.9	.007	360.0	.007
169.2	.007	361.0	.007
169.5	.007	362.0	.007
169.8	.007	363.0	.007
170.1	.007	364.0	.007
170.4	.007	365.0	.007
170.7	.007	366.0	.007
171.0	.007	367.0	.007
171.3	.007	368.0	.007
171.6	.007	369.0	.007
171.9	.007	370.0	.007
172.2	.007	371.0	.007
172.5	.007	372.0	.007
172.8	.007	373.0	.007
173.1	.007	374.0	.007
173.4	.007	375.0	.007
173.7	.007	376.0	.007
174.0	.007	377	

TABLE 20.- Concluded  
(f) Angle of scatter of  $60^\circ$

Energy, MeV	Cross section, $\mu\text{b}/\text{sr}-\text{MeV}$	Cross section, $\mu\text{b}/\text{sr}-\text{MeV}$
1.5	1.2	1.1
13.8	1.5	1.8
11.8	1.9	1.9
11.7	1.7	1.7
16.8	1.7	1.7
17.1	1.7	1.7
17.7	1.7	1.7
17.9	1.7	1.7
18.1	1.7	1.7
18.3	1.7	1.7
18.5	1.7	1.7
18.7	1.7	1.7
18.9	1.7	1.7
19.1	1.7	1.7
19.3	1.7	1.7
19.5	1.7	1.7
19.7	1.7	1.7
19.9	1.7	1.7
20.1	1.7	1.7
20.3	1.7	1.7
20.5	1.7	1.7
20.7	1.7	1.7
20.9	1.7	1.7
21.1	1.7	1.7
21.3	1.7	1.7
21.5	1.7	1.7
21.7	1.7	1.7
21.9	1.7	1.7
22.1	1.7	1.7
22.3	1.7	1.7
22.5	1.7	1.7
22.7	1.7	1.7
22.9	1.7	1.7
23.1	1.7	1.7
23.3	1.7	1.7
23.5	1.7	1.7
23.7	1.7	1.7
23.9	1.7	1.7
24.1	1.7	1.7
24.3	1.7	1.7
24.5	1.7	1.7
24.7	1.7	1.7
24.9	1.7	1.7
25.1	1.7	1.7
25.3	1.7	1.7
25.5	1.7	1.7
25.7	1.7	1.7
25.9	1.7	1.7
26.1	1.7	1.7
26.3	1.7	1.7
26.5	1.7	1.7
26.7	1.7	1.7
26.9	1.7	1.7
27.1	1.7	1.7
27.3	1.7	1.7
27.5	1.7	1.7
27.7	1.7	1.7
27.9	1.7	1.7
28.1	1.7	1.7
28.3	1.7	1.7
28.5	1.7	1.7
28.7	1.7	1.7
28.9	1.7	1.7
29.1	1.7	1.7
29.3	1.7	1.7
29.5	1.7	1.7
29.7	1.7	1.7
29.9	1.7	1.7
30.1	1.7	1.7
30.3	1.7	1.7
30.5	1.7	1.7
30.7	1.7	1.7
30.9	1.7	1.7
31.1	1.7	1.7
31.3	1.7	1.7
31.5	1.7	1.7
31.7	1.7	1.7
31.9	1.7	1.7
32.1	1.7	1.7
32.3	1.7	1.7
32.5	1.7	1.7
32.7	1.7	1.7
32.9	1.7	1.7
33.1	1.7	1.7
33.3	1.7	1.7
33.5	1.7	1.7
33.7	1.7	1.7
33.9	1.7	1.7
34.1	1.7	1.7
34.3	1.7	1.7
34.5	1.7	1.7
34.7	1.7	1.7
34.9	1.7	1.7
35.1	1.7	1.7
35.3	1.7	1.7
35.5	1.7	1.7
35.7	1.7	1.7
35.9	1.7	1.7
36.1	1.7	1.7
36.3	1.7	1.7
36.5	1.7	1.7
36.7	1.7	1.7
36.9	1.7	1.7
37.1	1.7	1.7
37.3	1.7	1.7
37.5	1.7	1.7
37.7	1.7	1.7
37.9	1.7	1.7
38.1	1.7	1.7
38.3	1.7	1.7
38.5	1.7	1.7
38.7	1.7	1.7
38.9	1.7	1.7
39.1	1.7	1.7
39.3	1.7	1.7
39.5	1.7	1.7
39.7	1.7	1.7
39.9	1.7	1.7
40.1	1.7	1.7
40.3	1.7	1.7
40.5	1.7	1.7
40.7	1.7	1.7
40.9	1.7	1.7
41.1	1.7	1.7
41.3	1.7	1.7
41.5	1.7	1.7
41.7	1.7	1.7
41.9	1.7	1.7
42.1	1.7	1.7
42.3	1.7	1.7
42.5	1.7	1.7
42.7	1.7	1.7
42.9	1.7	1.7
43.1	1.7	1.7
43.3	1.7	1.7
43.5	1.7	1.7
43.7	1.7	1.7
43.9	1.7	1.7
44.1	1.7	1.7
44.3	1.7	1.7
44.5	1.7	1.7
44.7	1.7	1.7
44.9	1.7	1.7
45.1	1.7	1.7
45.3	1.7	1.7
45.5	1.7	1.7
45.7	1.7	1.7
45.9	1.7	1.7
46.1	1.7	1.7
46.3	1.7	1.7
46.5	1.7	1.7
46.7	1.7	1.7
46.9	1.7	1.7
47.1	1.7	1.7
47.3	1.7	1.7
47.5	1.7	1.7
47.7	1.7	1.7
47.9	1.7	1.7
48.1	1.7	1.7
48.3	1.7	1.7
48.5	1.7	1.7
48.7	1.7	1.7
48.9	1.7	1.7
49.1	1.7	1.7
49.3	1.7	1.7
49.5	1.7	1.7
49.7	1.7	1.7
49.9	1.7	1.7
50.1	1.7	1.7
50.3	1.7	1.7
50.5	1.7	1.7
50.7	1.7	1.7
50.9	1.7	1.7
51.1	1.7	1.7
51.3	1.7	1.7
51.5	1.7	1.7
51.7	1.7	1.7
51.9	1.7	1.7
52.1	1.7	1.7
52.3	1.7	1.7
52.5	1.7	1.7
52.7	1.7	1.7
52.9	1.7	1.7
53.1	1.7	1.7
53.3	1.7	1.7
53.5	1.7	1.7
53.7	1.7	1.7
53.9	1.7	1.7
54.1	1.7	1.7
54.3	1.7	1.7
54.5	1.7	1.7
54.7	1.7	1.7
54.9	1.7	1.7
55.1	1.7	1.7
55.3	1.7	1.7
55.5	1.7	1.7
55.7	1.7	1.7
55.9	1.7	1.7
56.1	1.7	1.7
56.3	1.7	1.7
56.5	1.7	1.7
56.7	1.7	1.7
56.9	1.7	1.7
57.1	1.7	1.7
57.3	1.7	1.7
57.5	1.7	1.7
57.7	1.7	1.7
57.9	1.7	1.7
58.1	1.7	1.7
58.3	1.7	1.7
58.5	1.7	1.7
58.7	1.7	1.7
58.9	1.7	1.7
59.1	1.7	1.7
59.3	1.7	1.7
59.5	1.7	1.7
59.7	1.7	1.7
59.9	1.7	1.7
60.1	1.7	1.7
60.3	1.7	1.7
60.5	1.7	1.7
60.7	1.7	1.7
60.9	1.7	1.7
61.1	1.7	1.7
61.3	1.7	1.7
61.5	1.7	1.7
61.7	1.7	1.7
61.9	1.7	1.7
62.1	1.7	1.7
62.3	1.7	1.7
62.5	1.7	1.7
62.7	1.7	1.7
62.9	1.7	1.7
63.1	1.7	1.7
63.3	1.7	1.7
63.5	1.7	1.7
63.7	1.7	1.7
63.9	1.7	1.7
64.1	1.7	1.7
64.3	1.7	1.7
64.5	1.7	1.7
64.7	1.7	1.7
64.9	1.7	1.7
65.1	1.7	1.7
65.3	1.7	1.7
65.5	1.7	1.7
65.7	1.7	1.7
65.9	1.7	1.7
66.1	1.7	1.7
66.3	1.7	1.7
66.5	1.7	1.7
66.7	1.7	1.7
66.9	1.7	1.7
67.1	1.7	1.7
67.3	1.7	1.7
67.5	1.7	1.7
67.7	1.7	1.7
67.9	1.7	1.7
68.1	1.7	1.7
68.3	1.7	1.7
68.5	1.7	1.7
68.7	1.7	1.7
68.9	1.7	1.7
69.1	1.7	1.7
69.3	1.7	1.7
69.5	1.7	1.7
69.7	1.7	1.7
69.9	1.7	1.7
70.1	1.7	1.7
70.3	1.7	1.7
70.5	1.7	1.7
70.7	1.7	1.7
70.9	1.7	1.7
71.1	1.7	1.7
71.3	1.7	1.7
71.5	1.7	1.7
71.7	1.7	1.7
71.9	1.7	1.7
72.1	1.7	1.7
72.3	1.7	1.7
72.5	1.7	1.7
72.7	1.7	1.7
72.9	1.7	1.7
73.1	1.7	1.7
73.3	1.7	1.7
73.5	1.7	1.7
73.7	1.7	1.7
73.9	1.7	1.7
74.1	1.7	1.7
74.3	1.7	1.7
74.5	1.7	1.7
74.7	1.7	1.7
74.9	1.7	1.7
75.1	1.7	1.7
75.3	1.7	1.7
75.5	1.7	1.7
75.7	1.7	1.7
75.9	1.7	1.7
76.1	1.7	1.7
76.3	1.7	1.7
76.5	1.7	1.7
76.7	1.7	1.7
76.9	1.7	1.7
77.1	1.7	1.7
77.3	1.7	1.7
77.5	1.7	1.7
77.7	1.7	1.7
77.9	1.7	1.7
78.1	1.7	1.7
78.3	1.7	1.7
78.5	1.7	1.7
78.7	1.7	1.7
78.9	1.7	1.7
79.1	1.7	1.7
79.3	1.7	1.7
79.5	1.7	1.7
79.7	1.7	1.7
79.9	1.7	1.7
80.1	1.7	1.7
80.3	1.7	1.7
80.5	1.7	1.7
80.7	1.7	1.7
80.9	1.7	1.7
81.1	1.7	1.7
81.3	1.7	1.7
81.5	1.7	1.7
81.7	1.7	1.7
81.9	1.7	1.7
82.1	1.7	1.7
82.3	1.7	1.7
82.5	1.7	1.7
82.7	1.7	1.7
82.9	1.7	1.7
83.1	1.7	1.7
83.3	1.7	1.7
83.5	1.7	1.7
83.7	1.7	1.7
83.9	1.7	1.7
84.1	1.7	1.7
84.3	1.7	1.7
84.5	1.7	1.7
84.7	1.7	1.7
84.9	1.7	1.7
85.1	1.7	1.7
85.3	1.7	1.7
85.5	1.7	1.7
85.7	1.7	1.7
85.9	1.7	1.7
86.1	1.7	1.7
86.3	1.7	1.7
86.5	1.7	1.7
86.7	1.7	1.7
86.9	1.7	1.7
87.1	1.7	1.7
87.3	1.7	1.7
87.5	1.7	1.7
87.7	1.7	1.7
87.9	1.7	1.7
88.1	1.7	1.7
88.3	1.7	1.7
88.5	1.7	1.7
88.7	1.7	1.7
88.9	1.7	1.7
89.1	1.7	1.7
89.3	1.7	1.7
89.5	1.7	1.7
89.7	1.7	1.7
89.9	1.7	1.7
90.1	1.7	1.7
90.3	1.7	1.7
90.5	1.7	1.7
90.7	1.7	1.7
90.9	1.7	1.7
91.1	1.7	1.7
91.3	1.7	1.7
91.5	1.7	1.7
91.7	1.7	1.7
91.9	1.7	1.7

TABLE 21.- DOUBLE DIFFERENTIAL CROSS SECTIONS FOR PRODUCTION OF  
SECONDARY DEUTERONS FROM IRON TARGET, 3.77 g/cm<sup>2</sup> THICK

[Incident proton energy, 558 MeV]

(a) Angle of scatter of 10°

Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV
88.8 ± 1.1	.000 ± .000	167.0 ± 2.9	.146 ± .015
89.9 ± 1.1	.384 ± .047	170.0 ± 3.0	.142 ± .014
91.0 ± 1.1	.274 ± .035	173.1 ± 3.1	.149 ± .015
92.2 ± 1.1	.262 ± .033	176.2 ± 3.1	.138 ± .014
93.4 ± 1.1	.223 ± .029	179.5 ± 3.2	.164 ± .015
94.6 ± 1.1	.226 ± .028	182.8 ± 3.3	.142 ± .013
95.8 ± 1.1	.221 ± .027	186.2 ± 3.4	.127 ± .012
97.1 ± 1.1	.254 ± .030	189.6 ± 3.5	.130 ± .013
98.3 ± 1.1	.215 ± .026	193.4 ± 3.6	.137 ± .013
99.7 ± 1.1	.197 ± .024	197.2 ± 3.8	.131 ± .013
101.0 ± 1.1	.206 ± .024	201.0 ± 3.9	.132 ± .013
102.3 ± 1.1	.165 ± .020	205.0 ± 4.0	.123 ± .012
103.7 ± 1.1	.192 ± .023	209.2 ± 4.1	.123 ± .012
105.2 ± 1.1	.175 ± .021	213.4 ± 4.1	.133 ± .012
106.6 ± 1.1	.201 ± .023	217.8 ± 4.4	.120 ± .010
108.1 ± 1.1	.181 ± .021	222.3 ± 4.6	.112 ± .010
109.6 ± 1.1	.176 ± .021	227.0 ± 4.7	.119 ± .010
111.1 ± 1.1	.143 ± .017	231.8 ± 4.7	.111 ± .010
111.7 ± 1.1	.211 ± .023	236.9 ± 5.0	.117 ± .011
112.3 ± 1.1	.173 ± .020	242.0 ± 5.2	.110 ± .010
113.9 ± 1.1	.169 ± .019	247.4 ± 5.6	.108 ± .009
114.5 ± 1.1	.163 ± .019	253.0 ± 5.8	.103 ± .009
115.1 ± 1.1	.177 ± .020	258.7 ± 6.0	.096 ± .009
116.0 ± 1.1	.169 ± .019	264.7 ± 6.3	.109 ± .010
117.7 ± 1.1	.163 ± .017	270.9 ± 6.5	.105 ± .009
119.4 ± 1.1	.173 ± .020	277.3 ± 6.8	.117 ± .010
121.1 ± 1.1	.169 ± .019	284.0 ± 7.0	.114 ± .010
122.8 ± 1.1	.168 ± .018	290.9 ± 7.3	.112 ± .010
124.5 ± 1.1	.158 ± .017	298.1 ± 7.3	.120 ± .010
126.2 ± 1.1	.158 ± .017	305.6 ± 7.6	.129 ± .010
128.0 ± 1.1	.158 ± .016	313.5 ± 7.9	.127 ± .010
130.6 ± 1.1	.150 ± .016	321.1 ± 8.3	.127 ± .010
132.3 ± 1.1	.160 ± .017	330.1 ± 8.6	.127 ± .010
134.0 ± 1.1	.164 ± .017	339.0 ± 9.0	.127 ± .010
135.7 ± 1.1	.138 ± .015	348.2 ± 9.4	.121 ± .010
137.4 ± 1.1	.181 ± .018	357.9 ± 10.3	.116 ± .010
139.1 ± 1.1	.177 ± .015	368.0 ± 10.8	.000 ± .000
141.2 ± 1.1	.148 ± .015	378.6 ± 11.3	.000 ± .000
143.9 ± 1.1	.155 ± .016	389.7 ± 11.9	.000 ± .000
145.6 ± 1.1	.148 ± .016	401.4 ± 12.5	.000 ± .000
148.3 ± 1.1	.148 ± .015	413.6 ± 13.1	.000 ± .000
150.0 ± 1.1	.148 ± .015	426.4 ± 13.1	.000 ± .000
152.7 ± 1.1	.148 ± .014	440.0 ± 13.8	.000 ± .000

TABLE 21.- Continued  
 (b) Angle of scatter of 20°

Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV
89.1	.000 ± .000	167.4	.2.9 ± .0.1
90.2	.269 ± .037	170.3	.104 ± .011
91.3	.260 ± .035	173.1	.101 ± .011
92.5	.168 ± .025	176.4	.056 ± .010
93.7	.198 ± .027	179.8	.107 ± .011
94.9	.213 ± .027	183.1	.088 ± .009
96.1	.189 ± .025	186.5	.093 ± .010
97.3	.144 ± .020	190.0	.082 ± .009
98.5	.156 ± .021	193.7	.080 ± .008
99.7	.202 ± .025	197.5	.088 ± .009
100.9	.147 ± .019	201.3	.083 ± .008
102.1	.141 ± .019	205.4	.078 ± .008
103.3	.141 ± .018	209.7	.067 ± .007
104.5	.151 ± .019	213.7	.071 ± .007
105.7	.148 ± .019	218.1	.078 ± .008
106.9	.162 ± .020	222.6	.065 ± .006
108.1	.135 ± .017	227.3	.062 ± .006
109.3	.141 ± .017	232.1	.066 ± .006
110.5	.134 ± .018	237.1	.059 ± .005
111.7	.144 ± .017	242.4	.054 ± .005
112.9	.107 ± .017	247.9	.057 ± .005
114.1	.142 ± .017	253.4	.062 ± .005
115.3	.133 ± .017	258.1	.054 ± .005
116.5	.107 ± .017	264.7	.051 ± .005
117.7	.141 ± .017	271.0	.049 ± .004
118.9	.130 ± .017	276.4	.044 ± .004
120.1	.101 ± .016	281.7	.041 ± .004
121.3	.135 ± .016	287.1	.039 ± .003
122.5	.101 ± .015	292.5	.031 ± .003
123.7	.141 ± .016	298.9	.026 ± .002
124.9	.130 ± .015	305.3	.027 ± .002
126.1	.101 ± .015	313.6	.029 ± .002
127.3	.135 ± .015	321.6	.020 ± .001
128.5	.101 ± .015	329.9	.011 ± .001
129.7	.118 ± .014	338.2	.011 ± .001
130.9	.136 ± .014	346.5	.011 ± .001
132.1	.100 ± .014	357.9	.011 ± .001
133.3	.112 ± .014	367.9	.011 ± .001
134.5	.127 ± .014	378.5	.011 ± .001
135.7	.118 ± .013	389.1	.011 ± .001
136.9	.104 ± .013	401.1	.011 ± .001
138.1	.111 ± .012	413.3	.011 ± .001
139.3	.129 ± .012	426.1	.011 ± .001
140.5	.105 ± .011	439.5	.011 ± .001

TABLE 21.- Continued

(c) Angle of scatter of  $30^\circ$ 

Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV
108.4	.079	222.6	.035
109.9	.091	227.3	.034
111.4	.099	232.1	.035
113.0	.081	237.1	.031
114.6	.121	242.1	.003
116.3	.101	247.9	.026
118.0	.088	253.6	.030
119.7	.097	258.4	.023
121.3	.084	264.2	.003
123.1	.090	271.1	.024
125.0	.084	277.9	.020
126.8	.086	284.7	.026
128.6	.068	291.5	.018
130.4	.073	298.3	.020
132.2	.105	305.1	.015
135.0	.080	313.9	.002
137.8	.087	321.7	.013
139.6	.083	330.5	.010
141.4	.079	338.3	.012
143.2	.069	348.1	.001
145.0	.064	357.9	.008
146.8	.054	367.7	.000
148.6	.060	378.5	.000
150.4	.059	401.3	.000
152.2	.064	413.1	.000
154.0	.054	426.9	.000
155.8	.069	439.7	.000
157.6	.057	468.5	.000
159.4	.067	501.3	.000
161.2	.056	518.1	.000
163.0	.061	537.9	.000
164.8	.059	557.7	.000
166.6	.060	579.5	.000
168.4	.058	601.3	.000
170.2	.060	625.1	.000
172.0	.056	651.8	.000
173.8	.054	679.7	.000
175.6	.059	709.7	.000
177.4	.051	742.1	.000
179.2	.047	777.1	.000
181.0	.043		
182.8	.041		
184.6	.037		

TABLE 21.- Continued

(d) Angle of scatter of  $40^\circ$ 

Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV
89.7	.000	168.8	.000
90.8	.000	171.8	.000
91.9	.020	174.9	.000
93.1	.017	178.1	.000
94.3	.014	181.4	.000
95.5	.014	184.8	.000
96.0	.012	188.3	.000
96.5	.012	191.8	.000
97.0	.011	195.5	.000
97.5	.010	199.3	.000
98.0	.010	203.2	.000
98.5	.010	207.3	.000
99.0	.010	211.5	.000
99.5	.009	215.8	.000
100.0	.009	220.2	.000
100.6	.009	224.6	.000
101.2	.009	229.0	.000
101.8	.008	233.5	.000
102.4	.008	239.5	.000
103.0	.008	244.8	.000
103.4	.008	250.2	.000
104.0	.008	255.5	.000
104.6	.008	261.7	.000
105.2	.007	267.0	.000
105.8	.007	274.0	.000
106.4	.007	280.7	.000
107.0	.007	287.4	.000
107.7	.007	294.7	.000
108.3	.007	301.3	.000
109.0	.007	309.3	.000
109.7	.007	317.3	.000
110.4	.007	325.5	.000
111.1	.007	334.1	.000
111.8	.007	343.1	.000
112.5	.007	352.6	.000
113.2	.007	362.4	.000
113.9	.007	372.7	.000
114.5	.007	383.4	.000
115.2	.007	394.7	.000
115.9	.007	406.6	.000
116.6	.007	412.1	.000
117.3	.007	432.1	.000
118.0	.007	445.9	.000
118.6	.007		
119.2	.007		
119.8	.007		
120.6	.007		
121.2	.007		
121.8	.007		
122.4	.007		
123.0	.007		
123.6	.007		
124.2	.007		
124.8	.007		
125.4	.007		
126.0	.007		
126.6	.007		
127.2	.007		
127.8	.007		
128.4	.007		
129.0	.007		
131.9	.007		
134.0	.007		
136.1	.007		
138.2	.007		
140.3	.007		
142.4	.007		
145.5	.007		
147.6	.007		
149.7	.007		
152.8	.007		
155.9	.007		
157.5	.007		
160.2	.007		
163.0	.007		
165.9	.007		

TABLE 21.- Continued

(e) Angle of scatter of 50°

Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV
89.7 ± 1.1	.000 ± .000	2.9 ± 3.0	.033 ± .003
90.8 ± 1.1	.151 ± .016	3.0 ± 3.1	.030 ± .003
91.9 ± 1.1	.151 ± .016	3.1 ± 3.2	.033 ± .003
93.0 ± 1.1	.103 ± .011	3.2 ± 3.3	.027 ± .002
94.1 ± 1.1	.103 ± .011	3.3 ± 3.4	.030 ± .003
95.2 ± 1.1	.056 ± .010	3.4 ± 3.5	.025 ± .002
96.3 ± 1.1	.056 ± .010	3.5 ± 3.6	.030 ± .002
97.4 ± 1.1	.056 ± .010	3.6 ± 3.7	.024 ± .002
98.5 ± 1.1	.056 ± .009	3.7 ± 3.8	.024 ± .002
99.6 ± 1.1	.056 ± .009	3.8 ± 3.9	.020 ± .002
100.7 ± 1.1	.056 ± .008	3.9 ± 4.0	.021 ± .002
101.8 ± 1.1	.056 ± .008	4.0 ± 4.1	.020 ± .002
102.9 ± 1.1	.056 ± .007	4.1 ± 4.2	.018 ± .002
104.0 ± 1.1	.056 ± .007	4.2 ± 4.3	.018 ± .001
105.1 ± 1.1	.056 ± .007	4.3 ± 4.4	.014 ± .001
106.2 ± 1.1	.056 ± .007	4.4 ± 4.5	.012 ± .001
107.3 ± 1.1	.056 ± .007	4.5 ± 4.6	.014 ± .001
108.4 ± 1.1	.056 ± .007	4.6 ± 4.7	.012 ± .001
109.5 ± 1.1	.056 ± .007	4.7 ± 4.8	.010 ± .000
110.6 ± 1.1	.056 ± .007	4.8 ± 4.9	.007 ± .000
111.7 ± 1.1	.056 ± .007	4.9 ± 5.0	.006 ± .000
112.8 ± 1.1	.056 ± .007	5.0 ± 5.1	.007 ± .000
113.9 ± 1.1	.056 ± .007	5.1 ± 5.2	.006 ± .000
115.0 ± 1.1	.056 ± .007	5.2 ± 5.3	.005 ± .000
116.1 ± 1.1	.056 ± .007	5.3 ± 5.4	.005 ± .000
117.2 ± 1.1	.056 ± .007	5.4 ± 5.5	.005 ± .000
118.3 ± 1.1	.056 ± .007	5.5 ± 5.6	.005 ± .000
119.4 ± 1.1	.056 ± .007	5.6 ± 5.7	.005 ± .000
120.5 ± 1.1	.056 ± .007	5.7 ± 5.8	.005 ± .000
121.6 ± 1.1	.056 ± .007	5.8 ± 5.9	.005 ± .000
122.7 ± 1.1	.056 ± .007	5.9 ± 6.0	.005 ± .000
123.8 ± 1.1	.056 ± .007	6.0 ± 6.1	.005 ± .000
124.9 ± 1.1	.056 ± .007	6.1 ± 6.2	.005 ± .000
126.0 ± 1.1	.056 ± .007	6.2 ± 6.3	.005 ± .000
127.1 ± 1.1	.056 ± .007	6.3 ± 6.4	.005 ± .000
128.2 ± 1.1	.056 ± .007	6.4 ± 6.5	.005 ± .000
129.3 ± 1.1	.056 ± .007	6.5 ± 6.6	.005 ± .000
130.4 ± 1.1	.056 ± .007	6.6 ± 6.7	.005 ± .000
131.5 ± 1.1	.056 ± .007	6.7 ± 6.8	.005 ± .000
132.6 ± 1.1	.056 ± .007	6.8 ± 6.9	.005 ± .000
133.7 ± 1.1	.056 ± .007	6.9 ± 7.0	.005 ± .000
134.8 ± 1.1	.056 ± .007	7.0 ± 7.1	.005 ± .000
135.9 ± 1.1	.056 ± .007	7.1 ± 7.2	.005 ± .000
137.0 ± 1.1	.056 ± .007	7.2 ± 7.3	.005 ± .000
138.1 ± 1.1	.056 ± .007	7.3 ± 7.4	.005 ± .000
139.2 ± 1.1	.056 ± .007	7.4 ± 7.5	.005 ± .000
140.3 ± 1.1	.056 ± .007	7.5 ± 7.6	.005 ± .000
141.4 ± 1.1	.056 ± .007	7.6 ± 7.7	.005 ± .000
142.5 ± 1.1	.056 ± .007	7.7 ± 7.8	.005 ± .000
143.6 ± 1.1	.056 ± .007	7.8 ± 7.9	.005 ± .000
144.7 ± 1.1	.056 ± .007	7.9 ± 8.0	.005 ± .000
145.8 ± 1.1	.056 ± .007	8.0 ± 8.1	.005 ± .000
146.9 ± 1.1	.056 ± .007	8.1 ± 8.2	.005 ± .000
148.0 ± 1.1	.056 ± .007	8.2 ± 8.3	.005 ± .000
149.1 ± 1.1	.056 ± .007	8.3 ± 8.4	.005 ± .000
150.2 ± 1.1	.056 ± .007	8.4 ± 8.5	.005 ± .000
151.3 ± 1.1	.056 ± .007	8.5 ± 8.6	.005 ± .000
152.4 ± 1.1	.056 ± .007	8.6 ± 8.7	.005 ± .000
153.5 ± 1.1	.056 ± .007	8.7 ± 8.8	.005 ± .000
154.6 ± 1.1	.056 ± .007	8.8 ± 8.9	.005 ± .000
155.7 ± 1.1	.056 ± .007	8.9 ± 9.0	.005 ± .000
156.8 ± 1.1	.056 ± .007	9.0 ± 9.1	.005 ± .000
157.9 ± 1.1	.056 ± .007	9.1 ± 9.2	.005 ± .000
159.0 ± 1.1	.056 ± .007	9.2 ± 9.3	.005 ± .000
160.1 ± 1.1	.056 ± .007	9.3 ± 9.4	.005 ± .000
161.2 ± 1.1	.056 ± .007	9.4 ± 9.5	.005 ± .000
162.3 ± 1.1	.056 ± .007	9.5 ± 9.6	.005 ± .000
163.4 ± 1.1	.056 ± .007	9.6 ± 9.7	.005 ± .000
164.5 ± 1.1	.056 ± .007	9.7 ± 9.8	.005 ± .000

TABLE 21.- Concluded

(f) Angle of scatter of 60°

Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV
89.7	.000	168.8	.000
90.8	.000	171.8	.000
91.9	.016	174.9	.000
93.1	.009	178.1	.000
94.3	.007	181.4	.000
95.5	.006	184.8	.000
96.8	.007	188.3	.000
98.0	.006	191.8	.000
99.3	.005	195.5	.000
100.6	.006	199.3	.000
102.0	.004	203.2	.000
103.4	.004	207.3	.000
104.8	.005	211.5	.000
106.2	.004	215.8	.000
107.7	.005	220.2	.000
109.2	.004	224.8	.000
110.7	.004	229.6	.000
112.2	.004	234.5	.000
113.8	.005	239.5	.000
115.5	.004	244.8	.000
117.1	.003	250.2	.000
118.8	.003	255.9	.000
120.6	.003	261.7	.000
122.4	.003	267.8	.000
124.1	.003	280.6	.000
126.1	.003	287.3	.000
128.0	.002	294.4	.000
129.9	.002	301.7	.000
131.9	.003	309.3	.000
134.0	.003	317.3	.000
136.1	.002	325.5	.000
138.2	.002	334.1	.000
140.0	.002	352.6	.000
142.7	.002	362.4	.000
145.0	.002	372.7	.000
147.4	.002	383.4	.000
149.8	.002	394.7	.000
152.3	.002	406.6	.000
154.9	.002	419.0	.000
157.5	.002	432.1	.000
160.2	.002	445.9	.000
163.0	.002	458.7	.000
165.1	.002	472.7	.000

TABLE 22.- DOUBLE DIFFERENTIAL CROSS SECTIONS FOR PRODUCTION OF  
SECONDARY DEUTERONS FROM COPPER TARGET, 2.79 g/cm<sup>2</sup> THICK

[Incident proton energy, 558 MeV]

(a) Angle of scatter of 10°

Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV
88.8	.375 ± .064	167.0 ± 2.9	.157 ± .018
89.9	.386 ± .060	170.0 ± 3.0	.170 ± .019
91.0	.272 ± .046	173.1 ± 3.1	.147 ± .017
92.2	.233 ± .040	176.3 ± 3.3	.161 ± .018
93.4	.219 ± .037	179.5 ± 3.5	.159 ± .018
94.6	.205 ± .034	182.8 ± 3.7	.147 ± .017
95.8	.227 ± .035	186.0 ± 3.9	.160 ± .017
97.1	.247 ± .036	189.2 ± 4.1	.155 ± .017
98.3	.236 ± .035	193.4 ± 4.3	.153 ± .017
99.7	.208 ± .031	197.6 ± 4.5	.166 ± .017
101.0	.244 ± .034	201.8 ± 4.7	.148 ± .017
102.3	.249 ± .035	205.0 ± 4.9	.146 ± .017
103.7	.152 ± .025	209.2 ± 5.1	.135 ± .017
105.2	.199 ± .029	213.4 ± 5.3	.136 ± .017
106.7	.175 ± .026	217.6 ± 5.5	.124 ± .017
108.1	.196 ± .028	221.8 ± 5.7	.136 ± .017
109.6	.175 ± .027	226.0 ± 5.9	.124 ± .017
111.0	.199 ± .026	230.2 ± 6.1	.136 ± .017
112.4	.171 ± .025	234.4 ± 6.3	.124 ± .017
113.8	.194 ± .023	238.6 ± 6.5	.136 ± .017
115.2	.171 ± .023	242.8 ± 6.7	.124 ± .017
116.6	.199 ± .026	247.0 ± 6.9	.136 ± .017
118.0	.171 ± .023	251.2 ± 7.1	.124 ± .017
119.4	.199 ± .026	255.4 ± 7.3	.136 ± .017
120.8	.171 ± .023	259.6 ± 7.5	.124 ± .017
122.2	.199 ± .026	263.8 ± 7.7	.136 ± .017
123.6	.171 ± .023	268.0 ± 7.9	.124 ± .017
125.0	.199 ± .026	272.2 ± 8.1	.136 ± .017
126.4	.171 ± .023	276.4 ± 8.3	.124 ± .017
127.8	.199 ± .026	280.6 ± 8.5	.136 ± .017
129.2	.171 ± .023	284.8 ± 8.7	.124 ± .017
130.6	.199 ± .026	289.0 ± 8.9	.136 ± .017
132.0	.171 ± .023	293.2 ± 9.1	.124 ± .017
133.4	.199 ± .026	297.4 ± 9.3	.136 ± .017
134.8	.171 ± .023	301.6 ± 9.5	.124 ± .017
136.2	.199 ± .026	305.8 ± 9.7	.136 ± .017
137.6	.171 ± .023	309.0 ± 9.9	.124 ± .017
139.0	.199 ± .026	313.2 ± 10.1	.136 ± .017
140.4	.171 ± .023	317.4 ± 10.3	.124 ± .017
141.8	.199 ± .026	321.6 ± 10.5	.136 ± .017
143.2	.171 ± .023	325.8 ± 10.7	.124 ± .017
144.6	.199 ± .026	330.0 ± 10.9	.136 ± .017
146.0	.171 ± .023	334.2 ± 11.1	.124 ± .017
147.4	.199 ± .026	338.4 ± 11.3	.136 ± .017
148.8	.171 ± .023	342.6 ± 11.5	.124 ± .017
150.2	.199 ± .026	346.8 ± 11.7	.136 ± .017
151.6	.171 ± .023	351.0 ± 11.9	.124 ± .017
153.0	.199 ± .026	355.2 ± 12.1	.136 ± .017
154.4	.171 ± .023	359.4 ± 12.3	.124 ± .017
155.8	.199 ± .026	363.6 ± 12.5	.136 ± .017
157.2	.171 ± .023	367.8 ± 12.7	.124 ± .017
158.6	.199 ± .026	372.0 ± 12.9	.136 ± .017
160.0	.171 ± .023	376.2 ± 13.1	.124 ± .017
161.4	.199 ± .026	380.4 ± 13.3	.136 ± .017
162.8	.171 ± .023	384.6 ± 13.5	.124 ± .017

TABLE 22.- Continued

(b) Angle of scatter of 20°

Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV
89	.390 ± .061	167.4 ± 2.9	.119 ± .014
90	.371 ± .055	170.3 ± 3.0	.114 ± .013
91	.269 ± .042	173.4 ± 3.1	.106 ± .013
92	.201 ± .032	176.5 ± 3.2	.100 ± .012
93	.197 ± .030	183.1 ± 3.3	.094 ± .011
94	.160 ± .026	186.5 ± 3.4	.093 ± .010
95	.122 ± .022	190.1 ± 3.5	.084 ± .009
96	.120 ± .020	193.7 ± 3.6	.088 ± .009
97	.117 ± .019	197.5 ± 3.7	.087 ± .009
98	.115 ± .018	201.3 ± 3.8	.081 ± .009
99	.115 ± .018	205.9 ± 3.9	.082 ± .009
100	.115 ± .018	210.3 ± 4.0	.079 ± .008
101	.115 ± .018	213.8 ± 4.1	.077 ± .008
102	.115 ± .018	218.3 ± 4.2	.082 ± .008
103	.115 ± .018	222.8 ± 4.3	.072 ± .008
104	.115 ± .018	227.3 ± 4.4	.057 ± .006
105	.115 ± .018	231.8 ± 4.5	.059 ± .006
106	.115 ± .018	236.3 ± 4.6	.062 ± .006
107	.115 ± .018	240.8 ± 4.7	.053 ± .005
108	.115 ± .018	245.3 ± 4.8	.058 ± .005
109	.115 ± .018	249.8 ± 4.9	.046 ± .004
110	.115 ± .018	254.3 ± 5.0	.033 ± .004
111	.115 ± .018	258.8 ± 5.1	.030 ± .003
112	.115 ± .018	263.3 ± 5.2	.033 ± .003
113	.115 ± .018	267.8 ± 5.3	.029 ± .002
114	.115 ± .018	272.3 ± 5.4	.028 ± .002
115	.115 ± .018	276.8 ± 5.5	.023 ± .002
116	.115 ± .018	281.3 ± 5.6	.000 ± .000
117	.115 ± .018	285.8 ± 5.7	.000 ± .000
118	.115 ± .018	290.3 ± 5.8	.000 ± .000
119	.115 ± .018	294.8 ± 5.9	.000 ± .000
120	.115 ± .018	299.3 ± 6.0	.000 ± .000
121	.115 ± .018	303.8 ± 6.1	.000 ± .000
122	.115 ± .018	308.3 ± 6.2	.000 ± .000
123	.115 ± .018	312.8 ± 6.3	.000 ± .000
124	.115 ± .018	317.3 ± 6.4	.000 ± .000
125	.115 ± .018	321.8 ± 6.5	.000 ± .000
126	.115 ± .018	326.3 ± 6.6	.000 ± .000
127	.115 ± .018	330.8 ± 6.7	.000 ± .000
128	.115 ± .018	335.3 ± 6.8	.000 ± .000
129	.115 ± .018	339.8 ± 6.9	.000 ± .000
130	.115 ± .018	344.3 ± 7.0	.000 ± .000
131	.115 ± .018	348.8 ± 7.1	.000 ± .000
132	.115 ± .018	353.3 ± 7.2	.000 ± .000
133	.115 ± .018	357.8 ± 7.3	.000 ± .000
134	.115 ± .018	362.3 ± 7.4	.000 ± .000
135	.115 ± .018	366.8 ± 7.5	.000 ± .000
136	.115 ± .018	371.3 ± 7.6	.000 ± .000
137	.115 ± .018	375.8 ± 7.7	.000 ± .000
138	.115 ± .018	380.3 ± 7.8	.000 ± .000
139	.115 ± .018	384.8 ± 7.9	.000 ± .000
140	.115 ± .018	389.3 ± 8.0	.000 ± .000
141	.115 ± .018	393.8 ± 8.1	.000 ± .000
142	.115 ± .018	398.3 ± 8.2	.000 ± .000
143	.115 ± .018	402.8 ± 8.3	.000 ± .000
144	.115 ± .018	407.3 ± 8.4	.000 ± .000
145	.115 ± .018	411.8 ± 8.5	.000 ± .000
146	.115 ± .018	416.3 ± 8.6	.000 ± .000
147	.115 ± .018	420.8 ± 8.7	.000 ± .000
148	.115 ± .018	425.3 ± 8.8	.000 ± .000
149	.115 ± .018	429.8 ± 8.9	.000 ± .000
150	.115 ± .018	434.3 ± 9.0	.000 ± .000
151	.115 ± .018	438.8 ± 9.1	.000 ± .000
152	.115 ± .018	443.3 ± 9.2	.000 ± .000
153	.115 ± .018	447.8 ± 9.3	.000 ± .000
154	.115 ± .018	452.3 ± 9.4	.000 ± .000
155	.115 ± .018	456.8 ± 9.5	.000 ± .000
156	.115 ± .018	461.3 ± 9.6	.000 ± .000
157	.115 ± .018	465.8 ± 9.7	.000 ± .000
158	.115 ± .018	470.3 ± 9.8	.000 ± .000
159	.115 ± .018	474.8 ± 9.9	.000 ± .000
160	.115 ± .018	479.3 ± 10.0	.000 ± .000

TABLE 22.-Continued

(c) Angle of scatter of  $30^\circ$

TABLE 22.- Continued

(d) Angle of scatter of 40°

Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV
89.7 ± 1.1	.262 ± .026	90.8 ± 1.1	.028 ± .020
91.9 ± 1.2	.252 ± .019	93.0 ± 1.3	.015 ± .013
95.5 ± 1.3	.185 ± .017	96.6 ± 1.4	.0015 ± .0013
98.5 ± 1.4	.177 ± .017	100.7 ± 1.5	.00015 ± .00013
102.4 ± 1.5	.164 ± .017	104.0 ± 1.6	.000015 ± .000013
106.7 ± 1.6	.150 ± .017	109.2 ± 1.7	.0000015 ± .0000013
110.9 ± 1.7	.147 ± .017	112.3 ± 1.8	.00000015 ± .00000013
115.7 ± 1.8	.140 ± .017	117.8 ± 1.9	.000000015 ± .000000013
120.4 ± 1.9	.137 ± .017	122.4 ± 2.0	.0000000015 ± .0000000013
124.9 ± 2.0	.130 ± .017	128.1 ± 2.1	.00000000015 ± .00000000013
131.4 ± 2.1	.124 ± .017	136.0 ± 2.2	.000000000015 ± .000000000013
145.1 ± 2.2	.117 ± .017		

TABLE 22.- Continued

(e) Angle of scatter of  $50^{\circ}$ 

Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV
89.7	.000	168.8	.004
1.1	.023	171.8	.037
1.7	.018	174.9	.031
2.3	.016	178.1	.029
3.0	.015	184.3	.025
4.0	.014	188.5	.021
5.3	.013	191.8	.019
7.1	.012	195.5	.016
9.7	.011	199.3	.014
13.0	.010	203.2	.012
17.7	.009	207.3	.010
23.7	.009	211.5	.009
32.7	.009	215.8	.008
44.7	.009	220.2	.008
60.0	.009	224.6	.008
84.0	.009	229.5	.008
115.0	.009	234.9	.008
154.0	.009	240.0	.008
202.0	.009	245.0	.008
260.0	.009	250.5	.008
330.0	.009	261.7	.008
420.0	.009	267.8	.008
520.0	.009	274.0	.008
640.0	.009	280.6	.008
800.0	.009	287.3	.008
1000.0	.009	294.7	.008
1250.0	.009	301.7	.008
1560.0	.009	309.3	.008
1920.0	.009	317.5	.008
2340.0	.009	325.1	.008
2840.0	.009	334.1	.008
3450.0	.009	343.7	.008
4190.0	.009	352.4	.008
4450.0	.009	362.4	.008
4960.0	.009	372.7	.008
5430.0	.009	383.4	.008
6000.0	.009	394.7	.008
6630.0	.009	406.6	.008
7300.0	.009	419.0	.008
8000.0	.009	432.9	.008
8800.0	.009	445.4	.008

TABLE 22.- Concluded

(f) Angle of scatter of  $60^\circ$ 

Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV
89.7	.000	168.8	.002
90.8	.000	171.8	.002
91.1	.016	174.4	.002
91.0	.011	181.4	.001
91.1	.009	184.8	.001
91.0	.008	188.3	.001
91.1	.008	191.8	.001
91.0	.006	195.5	.001
91.1	.007	203.2	.001
91.0	.007	207.5	.001
91.1	.007	215.8	.001
91.0	.007	220.2	.001
91.1	.007	223.9	.001
91.0	.006	225.0	.001
91.1	.006	226.7	.001
91.0	.005	227.4	.001
91.1	.005	280.6	.001
91.0	.005	287.3	.001
91.1	.005	294.7	.001
91.0	.004	301.7	.001
91.1	.004	309.3	.001
91.0	.004	317.3	.001
91.1	.004	325.5	.001
91.0	.003	334.1	.001
91.1	.003	352.6	.001
91.0	.003	372.7	.001
91.1	.003	383.4	.001
91.0	.003	394.7	.001
91.1	.002	406.6	.001
91.0	.002	419.0	.001
91.1	.002	432.9	.001

TABLE 23.- DOUBLE DIFFERENTIAL CROSS SECTIONS FOR PRODUCTION OF  
SECONDARY DEUTERONS FROM GERMANIUM TARGET, 5.26 g/cm<sup>2</sup> THICK

[Incident proton energy, 558 MeV]

(a) Angle of scatter of 10°

Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV
88.8 ± 1.1	.000 ± .000	167.0 ± 2.9	.146 ± .016
89.9 ± 1.1	.409 ± .057	170.0 ± 3.0	.137 ± .015
91.0 ± 1.1	.288 ± .043	173.1 ± 3.1	.136 ± .015
92.2 ± 1.1	.312 ± .043	176.2 ± 3.2	.168 ± .017
93.4 ± 1.1	.252 ± .036	179.5 ± 3.2	.146 ± .015
94.6 ± 1.1	.228 ± .032	182.8 ± 3.3	.133 ± .014
95.8 ± 1.1	.253 ± .034	186.2 ± 3.4	.133 ± .014
97.1 ± 1.2	.197 ± .028	189.8 ± 3.5	.144 ± .015
98.3 ± 1.2	.222 ± .030	193.4 ± 3.6	.154 ± .016
99.7 ± 1.2	.198 ± .027	197.2 ± 3.8	.137 ± .014
101.0 ± 1.2	.195 ± .026	201.0 ± 3.9	.119 ± .012
102.3 ± 1.2	.205 ± .027	205.0 ± 4.0	.131 ± .013
103.7 ± 1.2	.192 ± .026	209.2 ± 4.1	.140 ± .014
105.2 ± 1.2	.190 ± .025	213.7 ± 4.2	.121 ± .012
106.6 ± 1.2	.173 ± .023	217.8 ± 4.4	.124 ± .012
108.1 ± 1.2	.204 ± .024	221.0 ± 4.6	.116 ± .012
109.6 ± 1.2	.210 ± .026	225.0 ± 4.7	.127 ± .012
111.1 ± 1.2	.190 ± .022	229.0 ± 4.8	.123 ± .012
112.7 ± 1.2	.173 ± .021	233.0 ± 4.9	.114 ± .012
114.3 ± 1.2	.193 ± .019	236.0 ± 5.0	.093 ± .009
116.0 ± 1.2	.145 ± .021	240.0 ± 5.1	.092 ± .009
117.7 ± 1.2	.170 ± .021	244.0 ± 5.2	.105 ± .010
119.4 ± 1.2	.180 ± .022	247.0 ± 5.3	.105 ± .010
121.1 ± 1.2	.187 ± .023	251.0 ± 5.4	.108 ± .010
123.0 ± 1.2	.180 ± .022	255.0 ± 5.7	.109 ± .010
124.8 ± 1.2	.153 ± .019	259.0 ± 5.9	.105 ± .010
126.7 ± 1.2	.159 ± .019	263.0 ± 6.0	.114 ± .010
128.6 ± 1.2	.164 ± .020	267.0 ± 6.1	.108 ± .010
130.6 ± 1.2	.151 ± .018	271.0 ± 6.2	.121 ± .011
132.6 ± 1.2	.175 ± .020	275.0 ± 6.5	.112 ± .010
134.7 ± 1.2	.166 ± .019	279.0 ± 6.5	.096 ± .009
136.8 ± 1.2	.158 ± .018	283.0 ± 7.1	.111 ± .010
139.0 ± 1.2	.174 ± .020	287.0 ± 7.3	.124 ± .011
141.2 ± 1.2	.164 ± .019	291.0 ± 7.6	.119 ± .010
143.5 ± 1.2	.146 ± .017	295.0 ± 7.9	.116 ± .010
145.9 ± 1.2	.157 ± .018	305.0 ± 8.1	.111 ± .010
148.3 ± 1.2	.159 ± .018	313.0 ± 8.3	.107 ± .010
150.8 ± 1.2	.157 ± .017	321.0 ± 8.6	.090 ± .009
153.3 ± 1.2	.174 ± .017	329.0 ± 9.0	.090 ± .009
155.9 ± 1.2	.161 ± .017	348.0 ± 9.4	.090 ± .009
158.6 ± 1.2	.161 ± .017	357.0 ± 9.8	.090 ± .009
161.3 ± 1.2	.126 ± .014	368.0 ± 10.3	.090 ± .009
164.1 ± 1.2		378.0 ± 10.8	.090 ± .009
		389.7 ± 11.3	.090 ± .009
		401.4 ± 12.5	.090 ± .009
		426.4 ± 13.1	.090 ± .009
		440.0 ± 13.8	.090 ± .009

TABLE 23.- Continued  
 (b) Angle of scatter of  $20^{\circ}$

Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV
89.1	.000 ± .000	167.4	.003 ± .011
90.2	.312 ± .043	170.4	.094 ± .010
91.3	.301 ± .033	173.4	.088 ± .010
92.5	.251 ± .033	176.5	.090 ± .010
93.7	.226 ± .030	179.8	.098 ± .010
94.9	.216 ± .028	183.1	.095 ± .010
96.1	.175 ± .024	186.5	.093 ± .010
97.4	.195 ± .025	190.1	.093 ± .010
98.6	.196 ± .025	193.7	.093 ± .010
99.9	.185 ± .023	197.5	.094 ± .010
101.3	.169 ± .022	201.3	.094 ± .010
102.6	.186 ± .023	205.3	.093 ± .010
104.0	.146 ± .019	209.4	.093 ± .010
105.5	.140 ± .018	213.7	.094 ± .010
106.9	.153 ± .019	218.1	.094 ± .010
108.4	.166 ± .020	222.6	.094 ± .010
109.9	.144 ± .018	227.3	.094 ± .010
111.4	.135 ± .017	232.1	.095 ± .010
113.0	.141 ± .017	237.1	.095 ± .010
114.6	.155 ± .019	242.3	.095 ± .010
116.3	.126 ± .016	247.6	.095 ± .010
117.9	.136 ± .017	253.2	.095 ± .010
119.7	.181 ± .021	258.9	.095 ± .010
121.5	.150 ± .016	264.1	.095 ± .010
123.3	.123 ± .017	271.5	.096 ± .010
125.1	.144 ± .015	277.5	.096 ± .010
127.0	.125 ± .015	284.1	.096 ± .010
128.9	.115 ± .014	291.0	.097 ± .010
130.8	.117 ± .014	298.2	.097 ± .010
132.7	.115 ± .014	305.7	.097 ± .010
134.6	.118 ± .013	313.5	.097 ± .010
136.5	.118 ± .013	321.6	.097 ± .010
137.3	.118 ± .014	330.1	.097 ± .010
139.2	.128 ± .014	338.9	.097 ± .010
141.1	.113 ± .013	348.2	.097 ± .010
143.0	.113 ± .013	357.8	.097 ± .010
145.9	.120 ± .013	367.9	.097 ± .010
148.6	.105 ± .012	378.4	.097 ± .010
151.4	.092 ± .012	389.5	.097 ± .010
153.6	.116 ± .013	401.3	.097 ± .010
156.2	.103 ± .011	413.3	.097 ± .010
158.9	.098 ± .012	426.1	.097 ± .010
161.6	.112 ± .012	439.5	.097 ± .010
164.5	.109 ± .012		

TABLE 23.- Continued

(c) Angle of scatter of  $30^{\circ}$

Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV	
			1.1	1.1
89.1	1.1	1.1	1.1	1.1
90.2	1.1	1.1	1.1	1.1
91.3	1.1	1.1	1.1	1.1
92.5	1.1	1.1	1.1	1.1
93.7	1.1	1.1	1.1	1.1
94.9	1.1	1.1	1.1	1.1
96.1	1.1	1.1	1.1	1.1
97.3	1.1	1.1	1.1	1.1
98.6	1.1	1.1	1.1	1.1
99.9	1.1	1.1	1.1	1.1
101.2	1.1	1.1	1.1	1.1
102.5	1.1	1.1	1.1	1.1
103.8	1.1	1.1	1.1	1.1
105.1	1.1	1.1	1.1	1.1
106.4	1.1	1.1	1.1	1.1
107.7	1.1	1.1	1.1	1.1
109.0	1.1	1.1	1.1	1.1
110.3	1.1	1.1	1.1	1.1
111.6	1.1	1.1	1.1	1.1
112.9	1.1	1.1	1.1	1.1
114.2	1.1	1.1	1.1	1.1
115.5	1.1	1.1	1.1	1.1
116.8	1.1	1.1	1.1	1.1
118.1	1.1	1.1	1.1	1.1
119.4	1.1	1.1	1.1	1.1
120.7	1.1	1.1	1.1	1.1
122.0	1.1	1.1	1.1	1.1
123.3	1.1	1.1	1.1	1.1
124.6	1.1	1.1	1.1	1.1
125.9	1.1	1.1	1.1	1.1
127.2	1.1	1.1	1.1	1.1
128.5	1.1	1.1	1.1	1.1
129.8	1.1	1.1	1.1	1.1
131.1	1.1	1.1	1.1	1.1
132.4	1.1	1.1	1.1	1.1
133.7	1.1	1.1	1.1	1.1
135.0	1.1	1.1	1.1	1.1
136.3	1.1	1.1	1.1	1.1
137.6	1.1	1.1	1.1	1.1
138.9	1.1	1.1	1.1	1.1
140.2	1.1	1.1	1.1	1.1
141.5	1.1	1.1	1.1	1.1
142.8	1.1	1.1	1.1	1.1
144.1	1.1	1.1	1.1	1.1
145.4	1.1	1.1	1.1	1.1
146.7	1.1	1.1	1.1	1.1
148.0	1.1	1.1	1.1	1.1
149.3	1.1	1.1	1.1	1.1
150.6	1.1	1.1	1.1	1.1
151.9	1.1	1.1	1.1	1.1
153.2	1.1	1.1	1.1	1.1
154.5	1.1	1.1	1.1	1.1
155.8	1.1	1.1	1.1	1.1
157.1	1.1	1.1	1.1	1.1
158.4	1.1	1.1	1.1	1.1
159.7	1.1	1.1	1.1	1.1
161.0	1.1	1.1	1.1	1.1
162.3	1.1	1.1	1.1	1.1

TABLE 23.- Concluded

Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV
89.7	1.1	89.8	1.1
90.9	1.1	91.3	1.1
93.9	1.1	94.3	1.1
95.9	1.1	96.5	1.1
98.0	1.1	99.3	1.1
100.6	1.1	101.0	1.1
102.4	1.1	103.8	1.1
106.2	1.1	107.7	1.1
109.2	1.1	110.7	1.1
112.8	1.1	113.5	1.1
115.5	1.1	116.7	1.1
118.8	1.1	120.0	1.1
122.4	1.1	124.2	1.1
126.0	1.1	128.9	1.1
129.9	1.1	131.9	1.1
134.1	1.1	136.2	1.1
138.3	1.1	140.7	1.1
142.7	1.1	145.0	1.1
147.8	1.1	152.3	1.1
154.5	1.1	157.5	1.1
160.2	1.1	163.9	1.1

TABLE 24.- DOUBLE DIFFERENTIAL CROSS SECTIONS FOR PRODUCTION OF  
SECONDARY DEUTERONS FROM TUNGSTEN TARGET, 3.05 g/cm<sup>2</sup> THICK

[Incident proton energy, 558 Mev]

(a) Angle of scatter of 10°

Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV
88.9	.858 ± .140	165.7 ± 2.8	.260 ± .032
90.0	.591 ± .103	168.6 ± 2.9	.198 ± .026
91.1	.563 ± .094	171.6 ± 3.0	.238 ± .030
92.3	.397 ± .072	174.7 ± 3.1	.253 ± .029
93.5	.473 ± .078	177.8 ± 3.1	.212 ± .031
94.7	.353 ± .063	181.0 ± 3.2	.026 ± .026
95.9	.475 ± .073	184.4 ± 3.3	.024 ± .024
97.1	.392 ± .063	187.9 ± 3.4	.029 ± .029
98.4	.413 ± .064	191.3 ± 3.5	.024 ± .024
99.7	.406 ± .063	195.0 ± 3.6	.025 ± .025
101.0	.447 ± .066	198.7 ± 3.6	.023 ± .023
102.3	.365 ± .057	202.6 ± 3.9	.025 ± .025
103.7	.393 ± .059	206.6 ± 4.0	.024 ± .024
105.1	.402 ± .059	210.7 ± 4.1	.022 ± .022
106.5	.394 ± .058	214.9 ± 4.1	.019 ± .019
108.0	.343 ± .052	219.3 ± 5.0	.020 ± .020
109.5	.310 ± .048	223.8 ± 5.0	.025 ± .025
111.0	.341 ± .051	228.6 ± 5.0	.019 ± .019
112.5	.370 ± .053	233.3 ± 5.0	.020 ± .020
114.1	.311 ± .047	238.3 ± 5.0	.019 ± .019
115.6	.375 ± .052	243.4 ± 5.2	.018 ± .018
117.1	.305 ± .045	248.8 ± 5.6	.019 ± .019
118.6	.356 ± .050	254.3 ± 6.0	.019 ± .019
120.1	.392 ± .053	260.0 ± 6.2	.018 ± .018
121.6	.311 ± .047	265.1 ± 6.2	.018 ± .018
123.1	.375 ± .052	270.5 ± 6.7	.018 ± .018
124.6	.305 ± .045	276.5 ± 7.0	.018 ± .018
126.1	.356 ± .050	282.1 ± 7.2	.018 ± .018
127.6	.392 ± .053	288.1 ± 7.2	.018 ± .018
129.1	.294 ± .041	294.1 ± 7.7	.018 ± .018
130.6	.265 ± .041	300.6 ± 8.1	.017 ± .017
132.1	.305 ± .040	306.1 ± 8.1	.017 ± .017
133.6	.260 ± .038	312.6 ± 8.3	.017 ± .017
135.1	.305 ± .040	318.1 ± 8.3	.017 ± .017
136.6	.265 ± .038	324.6 ± 8.3	.017 ± .017
138.1	.305 ± .040	330.1 ± 8.3	.017 ± .017
140.5	.260 ± .038	336.6 ± 8.3	.017 ± .017
142.0	.305 ± .040	343.1 ± 8.3	.017 ± .017
143.5	.265 ± .038	349.6 ± 8.3	.017 ± .017
145.1	.305 ± .040	356.1 ± 8.3	.017 ± .017
146.6	.260 ± .038	362.6 ± 8.3	.000 ± .000
148.1	.305 ± .040	369.1 ± 10.2	.000 ± .000
149.6	.265 ± .038	375.6 ± 10.7	.000 ± .000
151.1	.305 ± .040	382.1 ± 11.7	.000 ± .000
152.6	.260 ± .038	388.6 ± 12.3	.000 ± .000
154.1	.305 ± .040	395.1 ± 12.3	.000 ± .000
155.6	.265 ± .038	401.6 ± 12.3	.000 ± .000
157.1	.305 ± .040	408.1 ± 12.3	.000 ± .000
160.1	.260 ± .038	415.6 ± 12.3	.000 ± .000
162.9	.305 ± .040	423.1 ± 12.3	.000 ± .000

TABLE 24.- Continued

(b) Angle of scatter of  $20^\circ$ 

Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV
88.9	.094	165.7	2.8
90.0	.070	168.6	2.2
91.2	.069	171.6	3.0
93.5	.061	174.7	1.1
94.7	.057	177.8	1.1
95.9	.053	181.0	1.1
97.1	.050	184.4	1.1
98.3	.049	187.8	1.1
99.7	.043	191.3	1.1
101.0	.043	195.0	1.1
102.3	.042	198.7	1.1
103.7	.042	202.6	1.1
105.1	.041	206.6	1.1
106.5	.041	210.7	1.1
108.0	.040	214.9	1.1
109.5	.040	219.3	1.1
111.0	.040	223.8	1.1
112.5	.039	228.5	1.1
114.1	.039	233.3	1.1
115.6	.039	238.4	1.1
117.1	.039	243.8	1.1
118.6	.039	248.3	1.1
120.1	.039	254.0	1.1
121.6	.039	260.0	1.1
123.1	.039	266.0	1.1
124.6	.039	272.1	1.1
126.1	.039	278.0	1.1
127.6	.039	285.1	1.1
129.1	.039	292.0	1.1
130.6	.039	299.6	1.1
132.1	.039	306.6	1.1
133.6	.039	314.4	1.1
135.1	.039	322.4	1.1
136.6	.039	330.8	1.1
138.1	.039	339.6	1.1
140.5	.039	348.3	1.1
142.9	.039	356.3	1.1
145.3	.039	368.3	1.1
147.8	.039	378.8	1.1
152.3	.039	389.7	1.1
154.9	.039	401.2	1.1
157.5	.039	413.2	1.1
160.1	.039	425.9	1.1

TABLE 24.- Continued  
(c) Angle of scatter of  $30^\circ$

Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV
88.9	.568	165.7	.015
90.0	.422	168.6	.014
91.2	.438	171.6	.012
92.3	.354	174.7	.013
93.5	.048	177.8	.014
94.7	.362	180.9	.012
95.9	.293	184.0	.013
97.1	.220	187.3	.011
98.4	.038	191.5	.011
99.7	.333	195.7	.011
101.0	.300	202.6	.010
102.1	.291	206.6	.010
103.2	.318	210.7	.009
104.5	.263	214.8	.008
105.7	.034	218.9	.008
106.9	.227	223.0	.007
108.1	.226	227.1	.007
109.3	.208	231.2	.006
110.5	.030	235.3	.006
111.7	.237	244.4	.005
112.9	.238	248.5	.005
114.1	.222	252.6	.005
115.3	.027	256.7	.005
116.5	.213	260.8	.005
117.7	.239	264.9	.005
118.9	.029	269.0	.005
120.1	.228	273.1	.005
121.3	.028	277.2	.005
122.5	.227	281.3	.005
123.7	.027	285.4	.005
124.9	.023	289.5	.005
126.1	.026	293.6	.005
127.3	.025	297.7	.005
128.5	.025	301.8	.005
129.7	.023	305.9	.005
130.9	.023	309.0	.005
132.1	.020	313.1	.005
133.3	.019	317.2	.005
134.5	.017	321.3	.005
135.7	.016	325.4	.005
136.9	.016	329.5	.005
138.1	.016	333.6	.005
139.3	.016	337.7	.005
140.5	.016	341.8	.005
141.7	.016	345.9	.005
142.9	.016	349.0	.005
144.1	.016	353.1	.005
145.3	.016	357.2	.005
146.5	.016	361.3	.005
147.7	.016	365.4	.005
148.9	.016	369.5	.005
150.1	.016	373.6	.005
151.3	.016	377.7	.005
152.5	.016	381.8	.005
153.7	.016	385.9	.005
154.9	.016	389.0	.005
156.1	.016	393.1	.005
157.3	.016	397.2	.005
158.5	.016	401.3	.005
159.7	.016	405.4	.005
160.9	.016	409.5	.005

TABLE 24.- Continued

(d) Angle of scatter of 40°

Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV
88.3	.079	165.7	2.8
90.0	.064	168.6	+ 2.9
91.1	.057	171.6	+ 3.0
92.3	.046	174.7	+ 3.1
93.7	.042	177.8	+ 3.2
95.0	.037	181.0	+ 3.3
96.4	.037	184.4	+ 3.4
97.1	.035	187.8	+ 3.5
98.1	.035	191.3	+ 3.6
99.7	.036	195.0	+ 3.7
101.0	.032	198.7	+ 3.8
102.3	.031	202.6	+ 3.9
103.7	.029	206.6	+ 4.0
105.1	.027	210.7	+ 4.1
106.5	.025	214.9	+ 4.2
108.0	.025	219.2	+ 4.3
109.5	.025	223.5	+ 4.4
111.0	.025	228.8	+ 4.5
112.5	.025	233.2	+ 4.6
114.1	.025	238.7	+ 4.7
115.7	.025	244.2	+ 4.8
117.4	.025	250.0	+ 4.9
119.1	.025	254.8	+ 5.0
120.8	.025	260.0	+ 5.1
122.6	.025	266.2	+ 5.2
124.4	.025	272.5	+ 5.3
126.2	.025	278.9	+ 5.4
128.1	.025	285.2	+ 5.5
130.1	.025	292.5	+ 5.6
132.1	.025	300.0	+ 5.7
134.1	.025	307.4	+ 5.8
136.2	.025	314.9	+ 5.9
138.3	.025	322.4	+ 6.0
140.5	.025	330.0	+ 6.1
142.8	.025	338.7	+ 6.2
145.4	.025	348.3	+ 6.3
147.9	.025	358.3	+ 6.4
152.3	.025	368.8	+ 6.5
154.9	.025	378.7	+ 6.6
157.5	.025	389.7	+ 6.7
160.1	.025	401.2	+ 6.8
162.5	.025	413.9	+ 6.9

TABLE 24.- Continued  
(e) Angle of scatter of 50°

Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV
86.3	.052	165.7	.2.8
90.0	.040	166.6	.2.9
91.2	.035	171.6	.3.0
92.5	.033	174.7	.3.1
95.7	.027	177.8	.3.1
97.1	.024	181.0	.4.1
98.7	.023	187.8	.4.7
99.7	.020	195.0	.7.0
101.0	.020	196.7	.6.7
102.3	.023	202.6	.6.7
103.7	.024	206.0	.9.0
105.1	.020	210.9	.5.3
106.5	.020	214.5	.5.3
108.0	.018	220.3	.3.3
109.5	.018	223.8	.3.3
111.0	.015	228.3	.8.3
111.4	.015	230.8	.8.3
111.8	.015	233.3	.8.3
112.2	.015	235.8	.8.3
112.6	.015	238.3	.8.3
113.0	.015	240.8	.8.3
113.4	.015	243.3	.8.3
113.8	.015	245.8	.8.3
114.2	.015	248.3	.8.3
114.6	.015	250.8	.8.3
115.0	.015	253.3	.8.3
115.4	.015	255.8	.8.3
115.8	.015	258.3	.8.3
116.2	.015	260.8	.8.3
116.6	.015	263.3	.8.3
117.0	.015	265.8	.8.3
117.4	.015	268.3	.8.3
117.8	.015	270.8	.8.3
118.2	.015	273.3	.8.3
118.6	.015	275.8	.8.3
119.0	.015	278.3	.8.3
119.4	.015	280.8	.8.3
119.8	.015	283.3	.8.3
120.2	.015	285.8	.8.3
120.6	.015	288.3	.8.3
121.0	.015	290.8	.8.3
121.4	.015	293.3	.8.3
121.8	.015	295.8	.8.3
122.2	.015	298.3	.8.3
122.6	.015	300.8	.8.3
123.0	.015	303.3	.8.3
123.4	.015	305.8	.8.3
123.8	.015	308.3	.8.3
124.2	.015	310.8	.8.3
124.6	.015	313.3	.8.3
125.0	.015	315.8	.8.3
125.4	.015	318.3	.8.3
125.8	.015	320.8	.8.3
126.2	.015	323.3	.8.3
126.6	.015	325.8	.8.3
127.0	.015	328.3	.8.3
127.4	.015	330.8	.8.3
127.8	.015	333.3	.8.3
128.2	.015	335.8	.8.3
128.6	.015	338.3	.8.3
129.0	.015	340.8	.8.3
129.4	.015	343.3	.8.3
129.8	.015	345.8	.8.3
130.2	.015	348.3	.8.3
130.6	.015	350.8	.8.3
131.0	.015	353.3	.8.3
131.4	.015	355.8	.8.3
131.8	.015	358.3	.8.3
132.2	.015	360.8	.8.3
132.6	.015	363.3	.8.3
133.0	.015	365.8	.8.3
133.4	.015	368.3	.8.3
133.8	.015	370.8	.8.3
134.2	.015	373.3	.8.3
134.6	.015	375.8	.8.3
135.0	.015	378.3	.8.3
135.4	.015	380.8	.8.3
135.8	.015	383.3	.8.3
136.2	.015	385.8	.8.3
136.6	.015	388.3	.8.3
137.0	.015	390.8	.8.3
137.4	.015	393.3	.8.3
137.8	.015	395.8	.8.3
138.2	.015	398.3	.8.3
138.6	.015	400.8	.8.3
139.0	.015	403.3	.8.3
139.4	.015	405.8	.8.3
139.8	.015	408.3	.8.3
140.2	.015	410.8	.8.3
140.6	.015	413.3	.8.3
141.0	.015	415.8	.8.3
141.4	.015	418.3	.8.3
141.8	.015	420.8	.8.3
142.2	.015	423.3	.8.3
142.6	.015	425.8	.8.3
143.0	.015	428.3	.8.3
143.4	.015	430.8	.8.3
143.8	.015	433.3	.8.3
144.2	.015	435.8	.8.3
144.6	.015	438.3	.8.3
145.0	.015	440.8	.8.3
145.4	.015	443.3	.8.3
145.8	.015	445.8	.8.3
146.2	.015	448.3	.8.3
146.6	.015	450.8	.8.3
147.0	.015	453.3	.8.3
147.4	.015	455.8	.8.3
147.8	.015	458.3	.8.3
148.2	.015	460.8	.8.3
148.6	.015	463.3	.8.3
149.0	.015	465.8	.8.3
149.4	.015	468.3	.8.3
149.8	.015	470.8	.8.3
150.2	.015	473.3	.8.3
150.6	.015	475.8	.8.3
151.0	.015	478.3	.8.3
151.4	.015	480.8	.8.3
151.8	.015	483.3	.8.3
152.2	.015	485.8	.8.3
152.6	.015	488.3	.8.3
153.0	.015	490.8	.8.3
153.4	.015	493.3	.8.3
153.8	.015	495.8	.8.3
154.2	.015	498.3	.8.3
154.6	.015	500.8	.8.3
155.0	.015	503.3	.8.3
155.4	.015	505.8	.8.3
155.8	.015	508.3	.8.3
156.2	.015	510.8	.8.3
156.6	.015	513.3	.8.3
157.0	.015	515.8	.8.3
157.4	.015	518.3	.8.3
157.8	.015	520.8	.8.3
158.2	.015	523.3	.8.3
158.6	.015	525.8	.8.3
159.0	.015	528.3	.8.3
159.4	.015	530.8	.8.3
159.8	.015	533.3	.8.3
160.2	.015	535.8	.8.3
160.6	.015	538.3	.8.3
161.0	.015	540.8	.8.3
161.4	.015	543.3	.8.3
161.8	.015	545.8	.8.3
162.2	.015	548.3	.8.3

TABLE 24.- Concluded

(f) Angle of scatter of  $60^\circ$

Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV
89.7	.321	168.8	2.9
90.8	.321	171.8	3.0
91.9	.329	174.9	3.2
93.1	.210	176.1	3.4
94.3	.177	181.4	3.5
95.5	.177	184.8	3.5
96.8	.177	188.3	3.5
98.0	.177	192.8	3.5
99.3	.177	195.5	3.5
100.6	.177	199.2	3.5
102.0	.177	203.4	3.5
103.4	.177	207.3	3.5
104.8	.177	211.2	3.5
106.2	.177	215.0	3.5
107.7	.177	219.8	3.5
109.2	.177	223.7	3.5
110.7	.177	227.5	3.5
112.2	.177	231.3	3.5
113.8	.177	235.1	3.5
115.4	.177	238.9	3.5
117.1	.177	242.7	3.5
118.7	.177	246.5	3.5
120.3	.177	250.3	3.5
122.0	.177	254.1	3.5
124.7	.177	257.9	3.5
126.4	.177	261.7	3.5
128.1	.177	265.5	3.5
129.8	.177	269.3	3.5
131.5	.177	273.1	3.5
133.2	.177	276.9	3.5
135.0	.177	280.7	3.5
136.7	.177	284.5	3.5
138.4	.177	288.3	3.5
140.1	.177	292.1	3.5
142.8	.177	295.9	3.5
145.5	.177	299.7	3.5
147.2	.177	303.5	3.5
149.9	.177	307.3	3.5
152.6	.177	311.1	3.5
154.3	.177	314.9	3.5
157.0	.177	318.7	3.5
160.7	.177	322.5	3.5
163.4	.177	326.3	3.5
165.1	.177	330.1	3.5

TABLE 25.- DOUBLE DIFFERENTIAL CROSS SECTIONS FOR PRODUCTION OF  
SECONDARY DEUTERONS FROM LEAD TARGET, 3.91 g/cm<sup>2</sup> THICK

[Incident proton energy, 558 MeV]

(a) Angle of scatter of 10°

Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV
68.8 ± 1.1	.788 ± .158	167.0 ± 2.9	.256 ± .036
69.9 ± 1.1	.873 ± .154	170.0 ± 3.0	.341 ± .034
71.0 ± 1.1	.573 ± .112	173.1 ± 3.1	.251 ± .035
72.2 ± 1.1	.487 ± .097	176.2 ± 3.1	.274 ± .036
73.4 ± 1.1	.554 ± .100	179.3 ± 3.2	.219 ± .031
74.6 ± 1.1	.454 ± .086	182.4 ± 3.3	.220 ± .030
75.8 ± 1.2	.582 ± .097	186.2 ± 3.4	.267 ± .035
77.1 ± 1.2	.289 ± .062	189.8 ± 3.5	.259 ± .033
78.3 ± 1.2	.459 ± .080	193.4 ± 3.6	.216 ± .029
79.7 ± 1.3	.311 ± .062	197.2 ± 3.8	.238 ± .031
81.0 ± 1.3	.396 ± .071	201.0 ± 3.9	.202 ± .027
82.3 ± 1.3	.427 ± .073	205.0 ± 4.0	.223 ± .029
83.7 ± 1.3	.383 ± .067	209.2 ± 4.1	.204 ± .026
85.2 ± 1.4	.378 ± .066	213.4 ± 4.3	.236 ± .026
86.6 ± 1.4	.331 ± .060	217.8 ± 4.4	.207 ± .026
88.1 ± 1.4	.360 ± .062	222.3 ± 4.6	.188 ± .024
89.6 ± 1.4	.348 ± .060	227.0 ± 4.7	.197 ± .024
91.0 ± 1.5	.398 ± .065	231.8 ± 4.9	.163 ± .021
92.5 ± 1.5	.415 ± .065	236.9 ± 5.0	.181 ± .022
93.9 ± 1.5	.416 ± .065	242.0 ± 5.2	.184 ± .023
95.3 ± 1.5	.262 ± .054	253.0 ± 5.4	.150 ± .020
96.7 ± 1.5	.312 ± .052	258.7 ± 5.6	.187 ± .020
98.1 ± 1.5	.365 ± .057	263.0 ± 5.8	.200 ± .020
99.5 ± 1.6	.253 ± .056	268.7 ± 6.0	.168 ± .019
100.9 ± 1.6	.290 ± .044	273.3 ± 6.3	.156 ± .019
102.3 ± 1.6	.248 ± .048	278.0 ± 6.5	.165 ± .019
103.7 ± 1.6	.060 ± .054	283.0 ± 6.7	.167 ± .019
105.2 ± 1.6	.060 ± .054	290.9 ± 7.0	.176 ± .020
106.6 ± 1.6	.060 ± .054	296.7 ± 7.3	.151 ± .017
108.1 ± 1.6	.060 ± .054	301.3 ± 7.6	.182 ± .020
109.5 ± 1.6	.060 ± .054	306.6 ± 8.0	.190 ± .020
111.1 ± 1.6	.060 ± .054	313.5 ± 8.3	.184 ± .020
112.5 ± 1.6	.060 ± .054	321.6 ± 8.6	.176 ± .019
114.3 ± 1.6	.060 ± .054	329.0 ± 9.0	.151 ± .018
115.6 ± 1.6	.060 ± .054	339.0 ± 9.4	.186 ± .018
117.0 ± 1.7	.060 ± .054	348.2 ± 9.8	.163 ± .018
118.4 ± 1.7	.060 ± .054	357.9 ± 10.3	.212 ± .021
119.7 ± 1.7	.060 ± .054	368.0 ± 10.8	.000 ± .000
121.1 ± 1.7	.060 ± .054	378.6 ± 11.3	.000 ± .000
122.5 ± 1.8	.060 ± .054	389.7 ± 11.9	.000 ± .000
124.0 ± 1.8	.060 ± .054	401.4 ± 12.5	.000 ± .000
125.3 ± 1.8	.060 ± .054	413.6 ± 13.1	.000 ± .000
126.7 ± 1.9	.060 ± .054	426.4 ± 13.8	.000 ± .000
128.1 ± 1.9	.060 ± .054	440.0 ± 14.0	.000 ± .000
129.5 ± 1.9	.060 ± .054	453.6 ± 14.6	.000 ± .000
130.9 ± 2.0	.060 ± .054	467.2 ± 15.2	.000 ± .000
132.3 ± 2.0	.060 ± .054	480.8 ± 15.8	.000 ± .000
133.7 ± 2.1	.060 ± .054	494.4 ± 16.4	.000 ± .000
135.1 ± 2.2	.060 ± .054	508.0 ± 17.0	.000 ± .000
136.5 ± 2.2	.060 ± .054	521.6 ± 17.6	.000 ± .000
137.9 ± 2.2	.060 ± .054	535.2 ± 18.2	.000 ± .000
139.3 ± 2.3	.060 ± .054	548.8 ± 18.8	.000 ± .000
140.7 ± 2.3	.060 ± .054	562.4 ± 19.4	.000 ± .000
142.1 ± 2.3	.060 ± .054	576.0 ± 20.0	.000 ± .000
143.5 ± 2.3	.060 ± .054	589.6 ± 20.6	.000 ± .000
144.9 ± 2.3	.060 ± .054	603.2 ± 21.2	.000 ± .000
146.3 ± 2.3	.060 ± .054	616.8 ± 21.8	.000 ± .000
147.7 ± 2.4	.060 ± .054	630.4 ± 22.4	.000 ± .000
149.1 ± 2.4	.060 ± .054	644.0 ± 23.0	.000 ± .000
150.5 ± 2.4	.060 ± .054	657.6 ± 23.6	.000 ± .000
151.9 ± 2.4	.060 ± .054	671.2 ± 24.2	.000 ± .000
153.3 ± 2.4	.060 ± .054	684.8 ± 24.8	.000 ± .000
154.7 ± 2.4	.060 ± .054	698.4 ± 25.4	.000 ± .000
156.1 ± 2.4	.060 ± .054	712.0 ± 26.0	.000 ± .000
157.5 ± 2.4	.060 ± .054	725.6 ± 26.6	.000 ± .000
158.9 ± 2.4	.060 ± .054	739.2 ± 27.2	.000 ± .000
160.3 ± 2.4	.060 ± .054	752.8 ± 27.8	.000 ± .000
161.7 ± 2.4	.060 ± .054	766.4 ± 28.4	.000 ± .000
163.1 ± 2.4	.060 ± .054	780.0 ± 29.0	.000 ± .000

TABLE 25.- Continued

(b) Angle of scatter of 20°

Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV
89.1	.737 ± .116	167.4 ± 2.9	.166 ± .022
90.2	.525 ± .087	170.3 ± 3.0	.203 ± .026
91.3	.569 ± .086	173.4 ± 3.1	.153 ± .020
92.5	.541 ± .080	176.5 ± 3.1	.151 ± .019
93.7	.559 ± .069	179.8 ± 3.2	.138 ± .018
94.9	.480 ± .069	183.5 ± 3.3	.021 ± .018
96.1	.293 ± .072	190.1 ± 3.5	.019 ± .018
97.4	.337 ± .072	193.7 ± 3.5	.152 ± .018
98.6	.365 ± .053	196.1 ± 3.5	.128 ± .016
99.9	.343 ± .051	197.5 ± 3.5	.151 ± .016
101.2	.333 ± .048	201.3 ± 3.4	.145 ± .017
102.6	.302 ± .045	205.4 ± 3.4	.126 ± .015
104.0	.276 ± .045	213.7 ± 3.4	.140 ± .016
105.5	.313 ± .045	218.1 ± 3.4	.113 ± .016
106.9	.314 ± .045	222.6 ± 3.4	.120 ± .014
108.3	.315 ± .045	227.1 ± 3.4	.119 ± .014
109.7	.301 ± .041	232.1 ± 3.4	.110 ± .014
111.1	.284 ± .041	237.1 ± 3.4	.104 ± .012
112.5	.256 ± .038	242.1 ± 3.4	.113 ± .013
113.9	.259 ± .037	247.2 ± 3.4	.093 ± .012
115.3	.264 ± .038	253.1 ± 3.4	.067 ± .009
116.7	.256 ± .037	258.1 ± 3.4	.058 ± .008
118.0	.264 ± .038	264.1 ± 3.4	.058 ± .010
119.4	.256 ± .037	271.1 ± 3.4	.058 ± .010
121.5	.247 ± .036	277.1 ± 3.4	.037 ± .010
123.3	.258 ± .036	282.1 ± 3.4	.031 ± .010
125.4	.277 ± .037	287.1 ± 3.4	.037 ± .010
127.0	.224 ± .037	291.1 ± 3.4	.078 ± .009
128.9	.222 ± .037	296.1 ± 3.4	.080 ± .009
130.9	.199 ± .033	305.7 ± 3.4	.065 ± .008
132.9	.206 ± .033	313.5 ± 3.4	.061 ± .007
135.0	.226 ± .029	321.6 ± 3.4	.052 ± .006
137.3	.217 ± .029	327.7 ± 3.4	.058 ± .006
139.3	.231 ± .031	330.1 ± 3.4	.049 ± .005
141.3	.184 ± .026	338.1 ± 3.4	.039 ± .005
143.2	.235 ± .030	348.1 ± 3.4	.036 ± .004
145.2	.217 ± .030	357.8 ± 3.4	.032 ± .004
147.1	.239 ± .030	367.5 ± 3.4	.037 ± .004
148.6	.186 ± .027	378.5 ± 3.4	.027 ± .003
150.6	.252 ± .030	389.5 ± 3.4	.027 ± .003
152.6	.208 ± .027	401.1 ± 3.4	.023 ± .003
154.6	.179 ± .023	413.3 ± 3.4	.026 ± .003
156.6	.186 ± .023	426.1 ± 3.4	.029 ± .003
158.6	.180 ± .023	439.5 ± 3.4	.026 ± .003
161.6	.196 ± .023	452.1 ± 3.4	.026 ± .003

TABLE 25.- Continued  
(c) Angle of scatter of 30°

TABLE 25.- Continued

(d) Angle of scatter of 40°

Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV
69.7	.534	168.8	.000
70.1	.496	171.8	.010
70.5	.503	174.1	.009
70.9	.040	178.1	.010
71.3	.038	181.4	.008
71.7	.036	184.8	.008
72.1	.030	188.3	.008
72.5	.028	191.5	.008
72.9	.032	193.3	.008
73.3	.029	196.5	.007
73.7	.026	199.3	.006
74.1	.024	203.2	.007
74.5	.027	207.5	.006
74.9	.023	211.8	.006
75.3	.025	215.6	.005
75.7	.022	219.5	.005
76.1	.025	223.4	.005
76.5	.022	227.3	.005
76.9	.025	231.2	.005
77.3	.022	235.0	.005
77.7	.025	238.9	.005
78.1	.022	242.7	.005
78.5	.025	246.6	.005
78.9	.022	250.5	.005
79.3	.025	254.3	.005
79.7	.022	258.2	.005
80.1	.025	262.1	.005
80.5	.022	265.9	.005
80.9	.025	269.7	.005
81.3	.022	273.6	.005
81.7	.025	277.4	.005
82.1	.022	281.3	.005
82.5	.025	285.1	.005
82.9	.022	288.9	.005
83.3	.025	292.7	.005
83.7	.022	296.5	.005
84.1	.025	300.3	.005
84.5	.022	304.1	.005
84.9	.025	307.9	.005
85.3	.022	311.7	.005
85.7	.025	315.5	.005
86.1	.022	319.3	.005
86.5	.025	323.1	.005
86.9	.022	326.9	.005
87.3	.025	330.7	.005
87.7	.022	334.5	.005
88.1	.025	338.3	.005
88.5	.022	342.1	.005
88.9	.025	345.9	.005
89.3	.022	349.7	.005
89.7	.025	353.5	.005
90.1	.022	357.3	.005
90.5	.025	361.1	.005
90.9	.022	364.9	.005
91.3	.025	368.7	.005
91.7	.022	372.5	.005
92.1	.025	376.3	.005
92.5	.022	380.1	.005
92.9	.025	383.9	.005
93.3	.022	387.7	.005
93.7	.025	391.5	.005
94.1	.022	395.3	.005
94.5	.025	399.1	.005
94.9	.022	402.9	.005
95.3	.025	406.7	.005
95.7	.022	410.5	.005
96.1	.025	414.3	.005
96.5	.022	418.1	.005
96.9	.025	421.9	.005
97.3	.022	425.7	.005
97.7	.025	429.5	.005
98.1	.022	433.3	.005
98.5	.025	437.1	.005
98.9	.022	440.9	.005
99.3	.025	444.7	.005
99.7	.022	448.5	.005
100.1	.025	452.3	.005
100.5	.022	456.1	.005
100.9	.025	459.9	.005
101.3	.022	463.7	.005
101.7	.025	467.5	.005
102.1	.022	471.3	.005
102.5	.025	475.1	.005
102.9	.022	478.9	.005
103.3	.025	482.7	.005
103.7	.022	486.5	.005
104.1	.025	490.3	.005
104.5	.022	494.1	.005
104.9	.025	497.9	.005
105.3	.022	501.7	.005
105.7	.025	505.5	.005
106.1	.022	509.3	.005
106.5	.025	513.1	.005
106.9	.022	516.9	.005
107.3	.025	520.7	.005
107.7	.022	524.5	.005
108.1	.025	528.3	.005
108.5	.022	532.1	.005
108.9	.025	535.9	.005
109.3	.022	539.7	.005
109.7	.025	543.5	.005
110.1	.022	547.3	.005
110.5	.025	551.1	.005
110.9	.022	554.9	.005
111.3	.025	558.7	.005
111.7	.022	562.5	.005
112.1	.025	566.3	.005
112.5	.022	570.1	.005
112.9	.025	573.9	.005
113.3	.022	577.7	.005
113.7	.025	581.5	.005
114.1	.022	585.3	.005
114.5	.025	589.1	.005
114.9	.022	592.9	.005
115.3	.025	596.7	.005
115.7	.022	600.5	.005
116.1	.025	604.3	.005
116.5	.022	608.1	.005
116.9	.025	611.9	.005
117.3	.022	615.7	.005
117.7	.025	619.5	.005
118.1	.022	623.3	.005
118.5	.025	627.1	.005
118.9	.022	630.9	.005
119.3	.025	634.7	.005
119.7	.022	638.5	.005
120.1	.025	642.3	.005
120.5	.022	646.1	.005
120.9	.025	650.9	.005
121.3	.022	654.7	.005
121.7	.025	658.5	.005
122.1	.022	662.3	.005
122.5	.025	666.1	.005
122.9	.022	670.9	.005
123.3	.025	674.7	.005
123.7	.022	678.5	.005
124.1	.025	682.3	.005
124.5	.022	686.1	.005
124.9	.025	690.9	.005
125.3	.022	694.7	.005
125.7	.025	698.5	.005
126.1	.022	702.3	.005
126.5	.025	706.1	.005
126.9	.022	710.9	.005
127.3	.025	714.7	.005
127.7	.022	718.5	.005
128.1	.025	722.3	.005
128.5	.022	726.1	.005
128.9	.025	730.9	.005
129.3	.022	734.7	.005
129.7	.025	738.5	.005
130.1	.022	742.3	.005
130.5	.025	746.1	.005
130.9	.022	750.9	.005
131.3	.025	754.7	.005
131.7	.022	758.5	.005
132.1	.025	762.3	.005
132.5	.022	766.1	.005
132.9	.025	770.9	.005
133.3	.022	774.7	.005
133.7	.025	778.5	.005
134.1	.022	782.3	.005
134.5	.025	786.1	.005
134.9	.022	790.9	.005
135.3	.025	794.7	.005
135.7	.022	798.5	.005
136.1	.025	802.3	.005
136.5	.022	806.1	.005
136.9	.025	810.9	.005
137.3	.022	814.7	.005
137.7	.025	818.5	.005
138.1	.022	822.3	.005
138.5	.025	826.1	.005
138.9	.022	830.9	.005
139.3	.025	834.7	.005
139.7	.022	838.5	.005
140.1	.025	842.3	.005
140.5	.022	846.1	.005
140.9	.025	850.9	.005
141.3	.022	854.7	.005
141.7	.025	858.5	.005
142.1	.022	862.3	.005
142.5	.025	866.1	.005
142.9	.022	870.9	.005
143.3	.025	874.7	.005
143.7	.022	878.5	.005
144.1	.025	882.3	.005
144.5	.022	886.1	.005
144.9	.025	890.9	.005
145.3	.022	894.7	.005
145.7	.025	898.5	.005
146.1	.022	902.3	.005
146.5	.025	906.1	.005
146.9	.022	910.9	.005
147.3	.025	914.7	.005
147.7	.022	918.5	.005
148.1	.025	922.3	.005
148.5	.022	926.1	.005
148.9	.025	930.9	.005
149.3	.022	934.7	.005
149.7	.025	938.5	.005
150.1	.022	942.3	.005
150.5	.025	946.1	.005
150.9	.022	950.9	.005
151.3	.025	954.7	.005
151.7	.022	958.5	.005
152.1	.025	962.3	.005
152.5	.022	966.1	.005
152.9	.025	970.9	.005
153.3	.022	974.7	.005
153.7	.025	978.5	.005
154.1	.022	982.3	.005
154.5	.025	986.1	.005
154.9	.022	990.9	.005
155.3	.025	994.7	.005
155.7	.022	998.5	.005
156.1	.025	1002.3	.005
156.5	.022	1006.1	.005
156.9	.025	1010.9	.005
157.3	.022	1014.7	.005
157.7	.025	1018.5	.005
158.1	.022	1022.3	.005
158.5	.025	1026.1	.005
158.9	.022	1030.9	.005
159.3	.025	1034.7	.005
159.7	.022	1038.5	.005
160.1	.025	1042.3	.005
160.5	.022	1046.1	.005
160.9	.025	1050.9	.005
161.3	.022	1054.7	.005
161.7	.025	1058.5	.005
162.1	.022	1062.3	.005
162.5	.025	1066.1	.005
162.9	.022	1070.9	.005
163.3	.025	1074.7	.005
163.7	.022	1078.5	.005
164.1	.025	1082.3	.005
164.5	.022	1086.1	.005
164.9	.025	1090.9	.005
165.3	.022	1094.7	.005
165.7	.025	1098.5	.005
166.1	.022	1102.3	.005
166.5	.025	1106.1	.005
166.9	.022	1110.9	.005
167.3	.025	1114.7	.005
167.7	.022	1118.5	.005
168.1	.025	1122.3	.005
168.5	.022	1126.1	.005
168.9	.025	1130.9	.005
169.3	.022	1134.7	.005
169.7	.025	1138.5	.005
170.1	.022	1142.3	.005
170.5	.025	1146.1	.005
170.9	.022	1150.9	.005
171.3	.025	1154.7	.005
171.7	.022	1158.5	.005
172.1	.025	1162.3	.005
172.5	.022	1166.1	.005
172.9	.025	1170.9	.005
173.3	.022	1174.7	.005
173.7	.025	1178.5	.005
174.1	.022	1182.3	.005
174.5	.025	1186.1	.005
174.9	.022	1190.9	.005
175.3	.025	1194.7	.005
175.7	.022	1198.5	.005
176.1	.025	1202.3	.005
176.5	.022	1206.1	.005
176.9	.025	1210.9	.005
177.3	.022	1214.7	.005
177.7	.025	1218.5	.005
178.1	.022	1222.3	.005
178.5	.025	1226.1	.005
178.9	.022	1230.9	.005
179.3	.025	1234.7</td	

TABLE 25.- Continued  
(e) Angle of scatter of  $50^{\circ}$

Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV
89.7	.053	168.8	2.9
90.8	.044	171.8	2.3
91.9	.038	174.9	3.0
93.1	.032	178.1	3.2
94.2	.029	181.4	3.3
95.3	.026	184.3	3.4
96.4	.024	188.3	3.5
97.5	.022	191.8	3.6
98.6	.022	195.5	3.7
99.7	.022	199.3	3.8
100.8	.022	203.2	3.9
101.9	.022	207.3	4.0
103.0	.022	211.2	4.1
104.1	.022	215.2	4.2
105.2	.022	219.2	4.3
106.3	.022	223.2	4.4
107.4	.022	227.2	4.5
108.5	.022	231.2	4.6
109.6	.022	235.2	4.7
110.7	.022	239.2	4.8
111.8	.022	243.2	4.9
112.9	.022	247.2	5.0
114.0	.022	251.2	5.1
115.1	.022	255.2	5.2
116.2	.022	259.2	5.3
117.3	.022	263.2	5.4
118.4	.022	267.2	5.5
119.5	.022	271.2	5.6
120.6	.022	275.2	5.7
121.7	.022	279.2	5.8
122.8	.022	283.2	5.9
123.9	.022	287.2	6.0
125.0	.022	291.2	6.1
126.1	.022	295.2	6.2
127.2	.022	299.2	6.3
128.3	.022	303.2	6.4
129.4	.022	307.2	6.5
130.5	.022	311.2	6.6
131.6	.022	315.2	6.7
132.7	.022	319.2	6.8
133.8	.022	323.2	6.9
134.9	.022	327.2	7.0
136.0	.022	331.2	7.1
137.1	.022	335.2	7.2
138.2	.022	339.2	7.3
139.3	.022	343.2	7.4
140.4	.022	347.2	7.5
141.5	.022	351.2	7.6
142.6	.022	355.2	7.7
143.7	.022	359.2	7.8
144.8	.022	363.2	7.9
145.9	.022	367.2	8.0
147.0	.022	371.2	8.1
148.1	.022	375.2	8.2
149.2	.022	379.2	8.3
150.3	.022	383.2	8.4
151.4	.022	387.2	8.5
152.5	.022	391.2	8.6
153.6	.022	395.2	8.7
154.7	.022	399.2	8.8
155.8	.022	403.2	8.9
156.9	.022	407.2	9.0
158.0	.022	411.2	9.1
159.1	.022	415.2	9.2
160.2	.022	419.2	9.3
161.3	.022	423.2	9.4
162.4	.022	427.2	9.5
163.5	.022	431.2	9.6
164.6	.022	435.2	9.7
165.7	.022	439.2	9.8
166.8	.022	443.2	9.9

TABLE 25.- Concluded

(f) Angle of scatter of  $60^\circ$

Energy, MeV	Cross section, mb/sr-MeV	Energy, MeV	Cross section, mb/sr-MeV
89.7	.000	168.8	.004
90.8	.030	171.3	.005
91.9	.025	174.9	.004
93.1	.023	178.1	.003
94.3	.022	181.4	.004
95.5	.021	184.8	.003
96.8	.020	188.3	.003
98.0	.016	191.8	.003
99.3	.019	195.5	.003
100.6	.016	199.3	.003
102.0	.014	203.2	.003
103.4	.016	207.3	.002
104.8	.014	211.5	.002
106.2	.015	215.8	.002
107.7	.013	220.2	.002
109.0	.016	224.5	.002
110.4	.017	228.9	.002
111.8	.014	233.5	.002
113.2	.018	237.9	.002
114.6	.015	242.4	.002
116.0	.013	246.9	.002
117.4	.012	250.5	.002
118.8	.011	255.7	.002
120.2	.011	261.7	.002
121.6	.009	267.8	.002
123.0	.010	274.0	.002
124.4	.008	280.6	.002
125.8	.009	287.3	.002
127.2	.008	294.4	.002
128.6	.009	301.7	.002
129.9	.008	309.3	.002
131.3	.009	317.3	.002
132.7	.008	325.6	.002
134.1	.009	334.1	.002
135.5	.008	342.7	.002
136.9	.009	352.6	.002
138.3	.008	362.4	.002
139.7	.009	372.7	.002
141.1	.008	383.4	.002
142.5	.007	394.7	.002
143.9	.006	406.6	.002
145.3	.005	419.0	.002
146.7	.005	432.1	.002
148.1	.006	442.9	.002
149.5	.005	452.7	.002
150.9	.006	462.5	.002
152.3	.005	472.3	.002
153.7	.006	482.1	.002
155.1	.005	492.9	.002
156.5	.006	502.7	.002
157.9	.005	512.5	.002
159.3	.006	522.3	.002
160.7	.005	532.1	.002
162.1	.006	542.9	.002
163.5	.005	552.7	.002
164.9	.006	562.5	.002
166.3	.005	572.3	.002

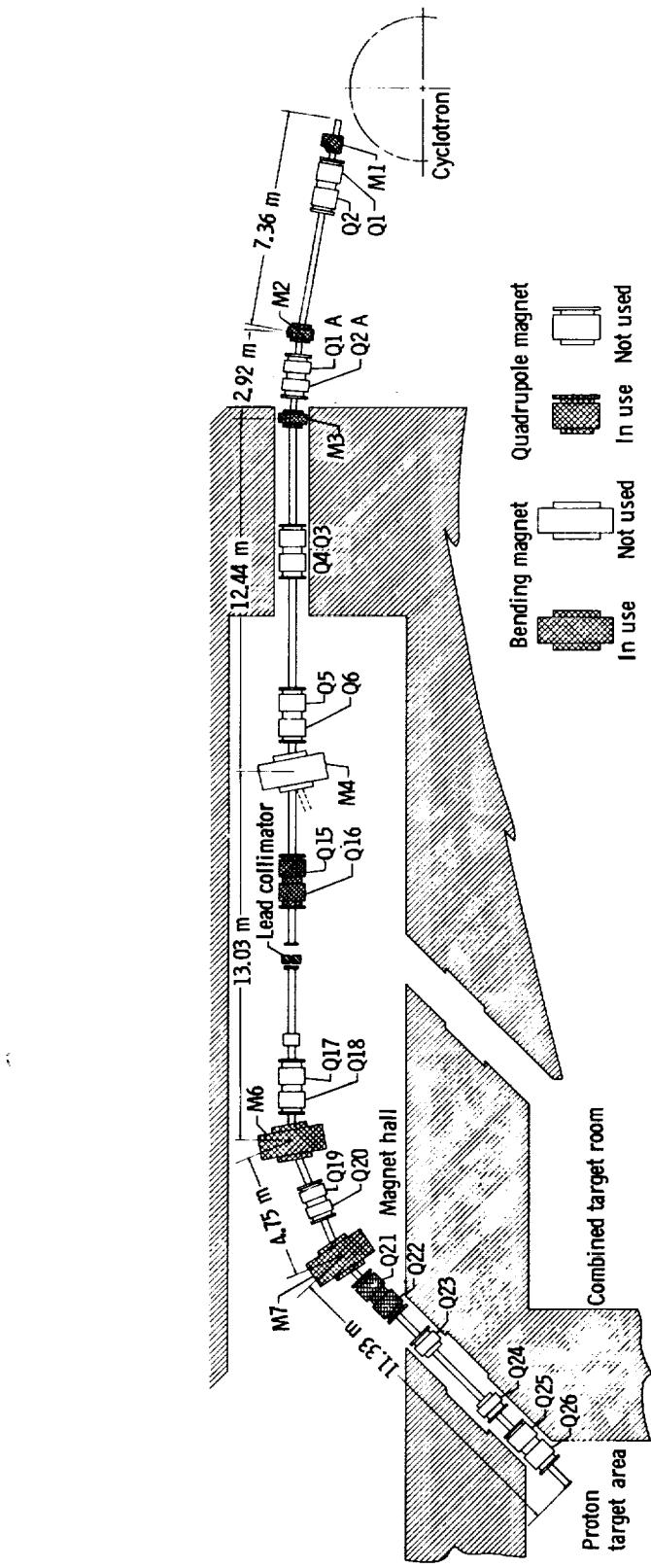


Figure 1.- Beam transport system from synchrocyclotron to proton target area.

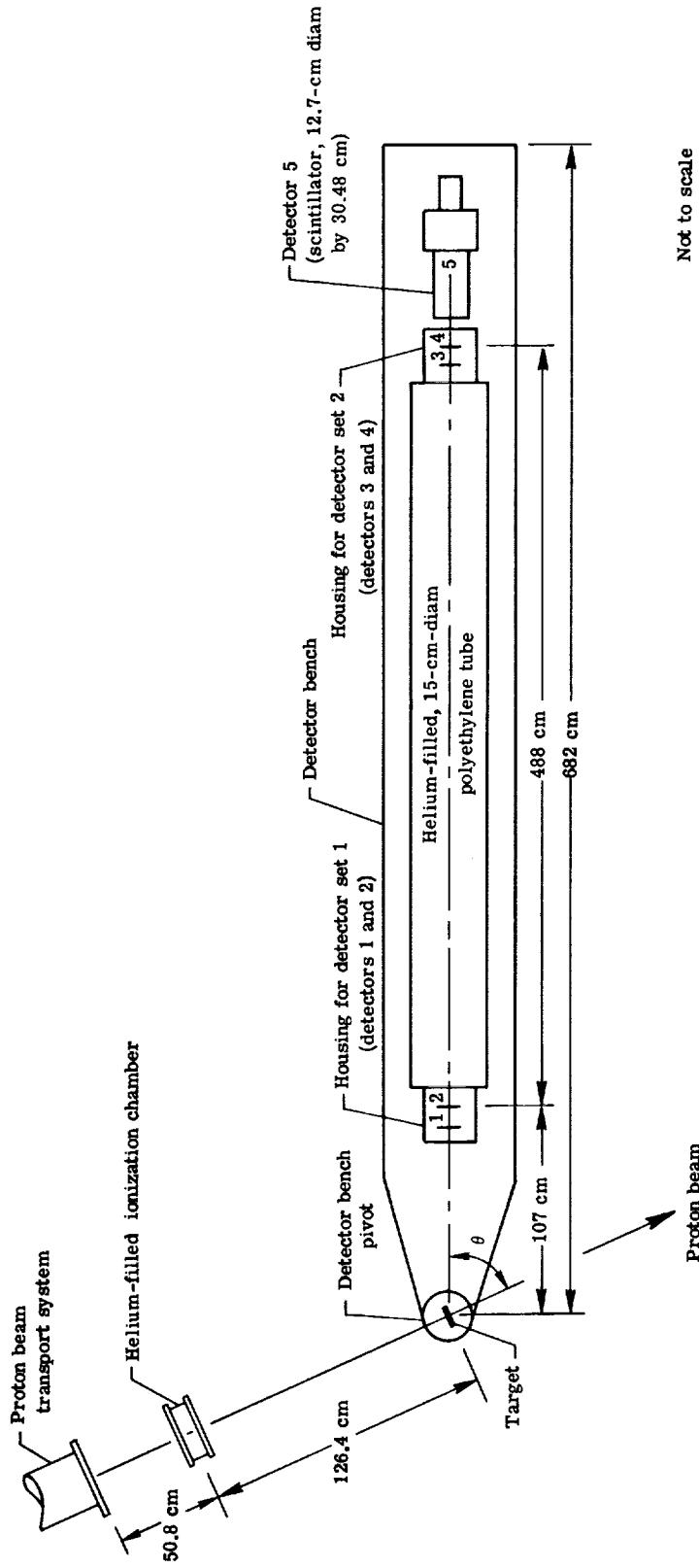
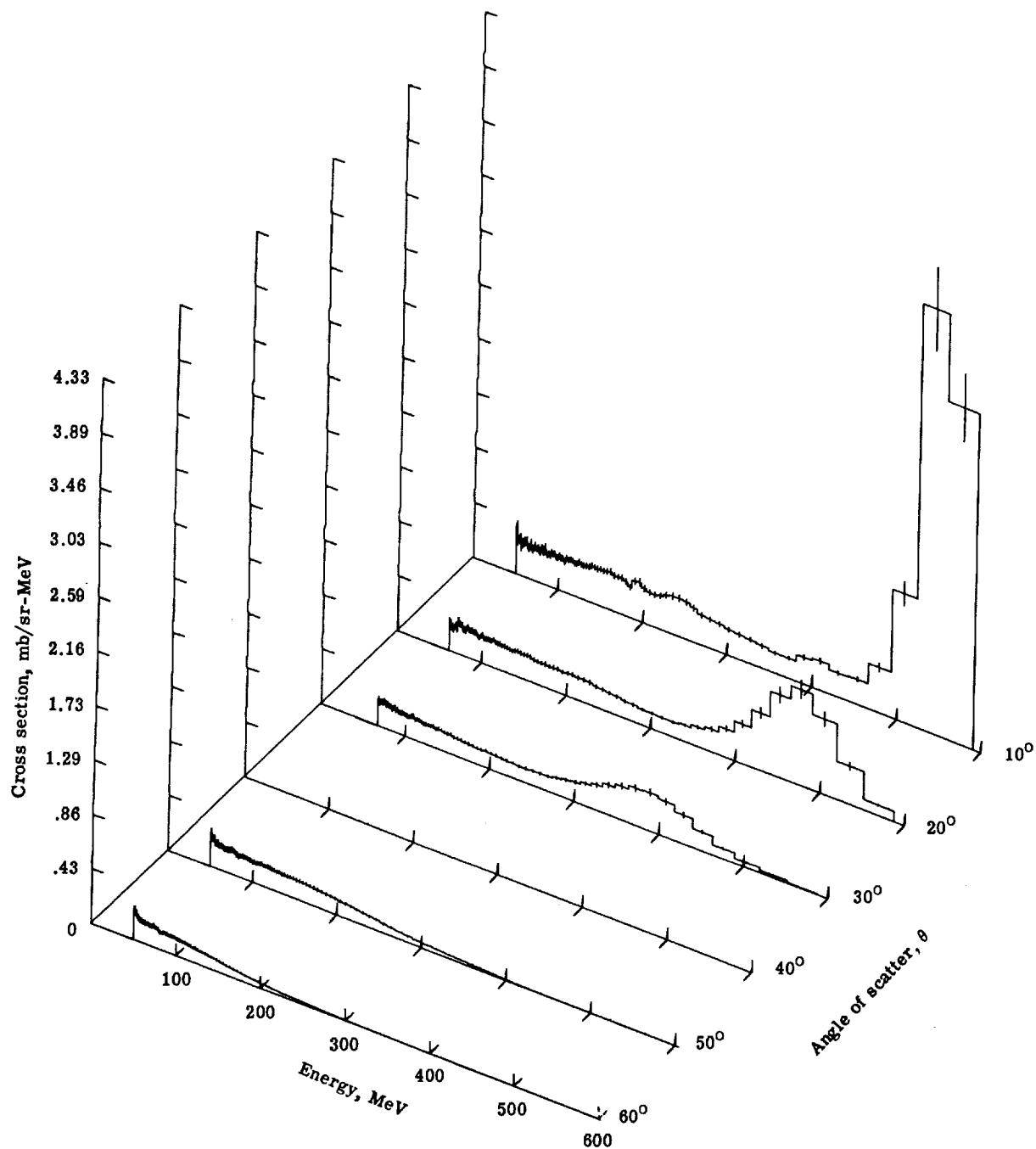
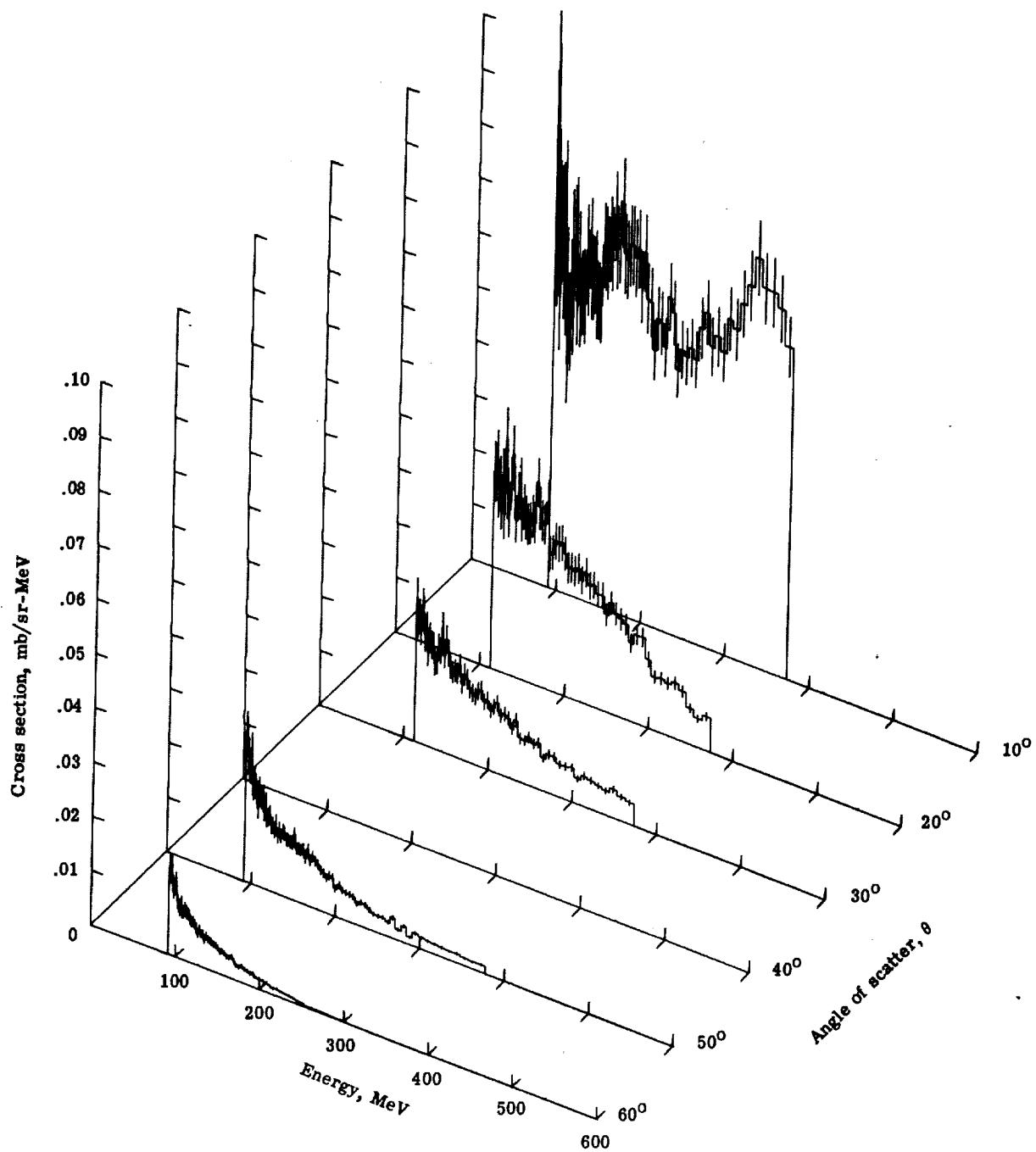


Figure 2.- Diagram of two-parameter scintillation spectrometer system.



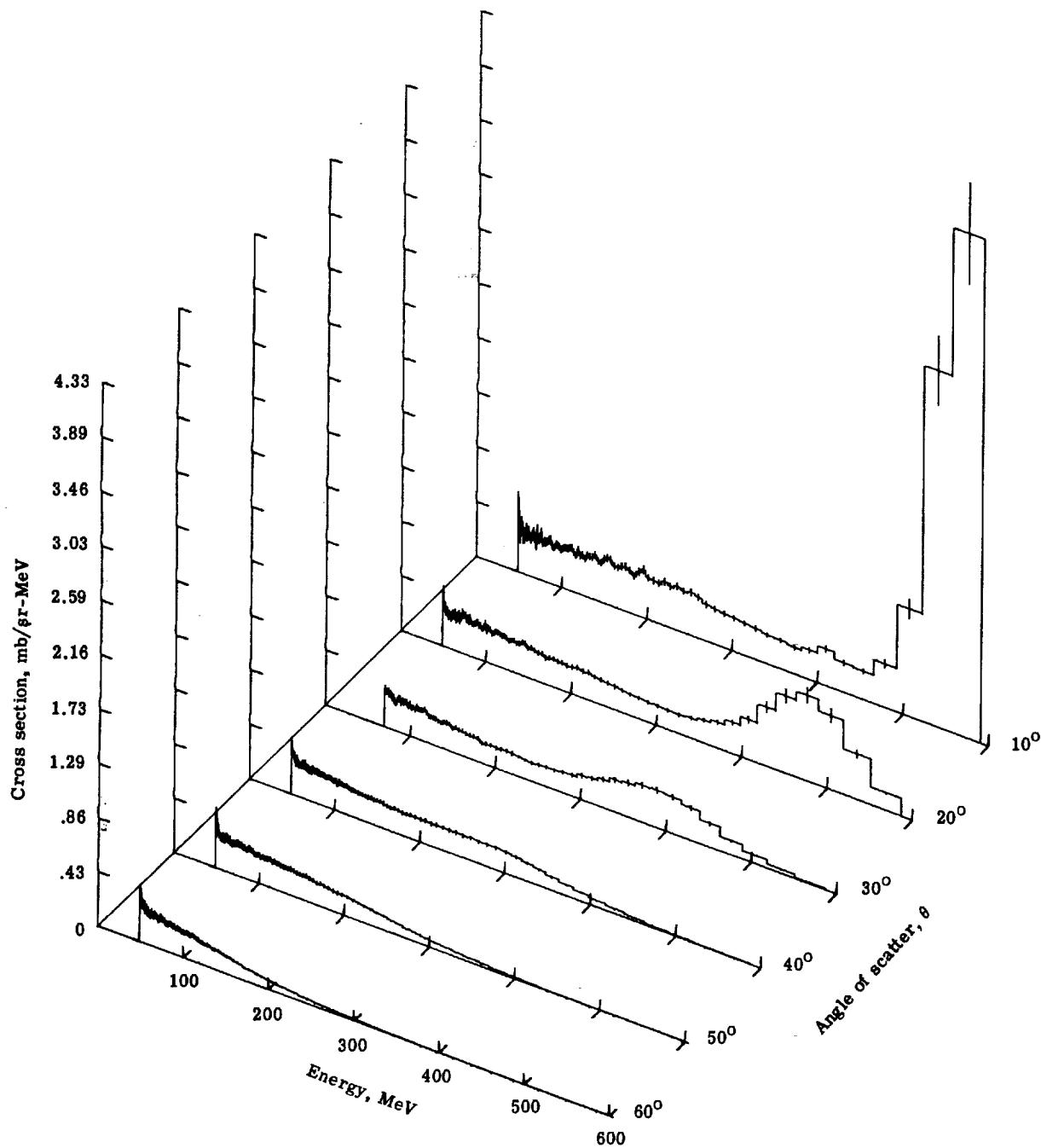
(a) Protons.

Figure 3.- Continuum spectra from beryllium target,  $2.35 \text{ g/cm}^2$  thick.  
Incident proton energy,  $558 \pm 7 \text{ MeV}$ .



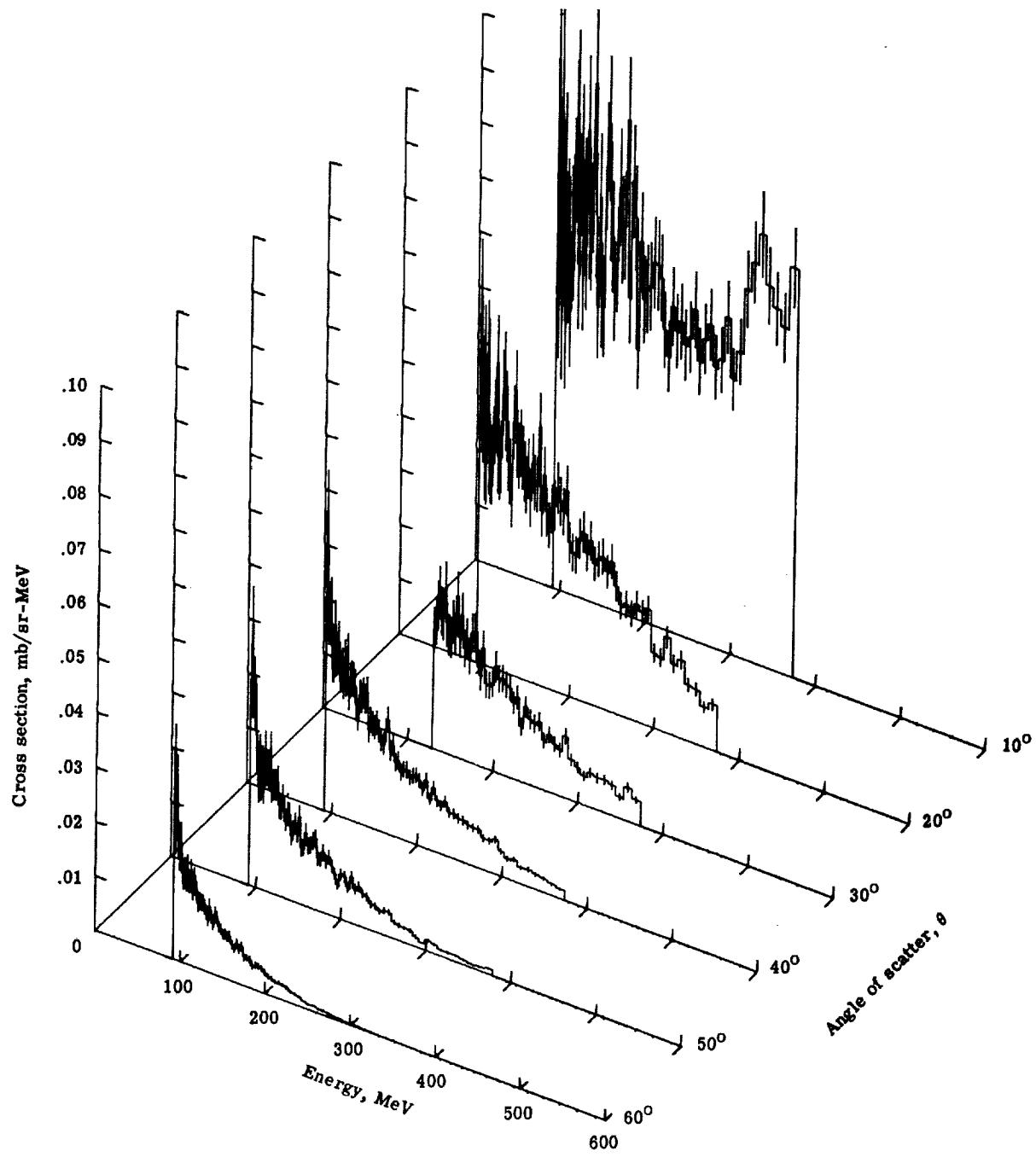
(b) Deuterons.

Figure 3.- Concluded.



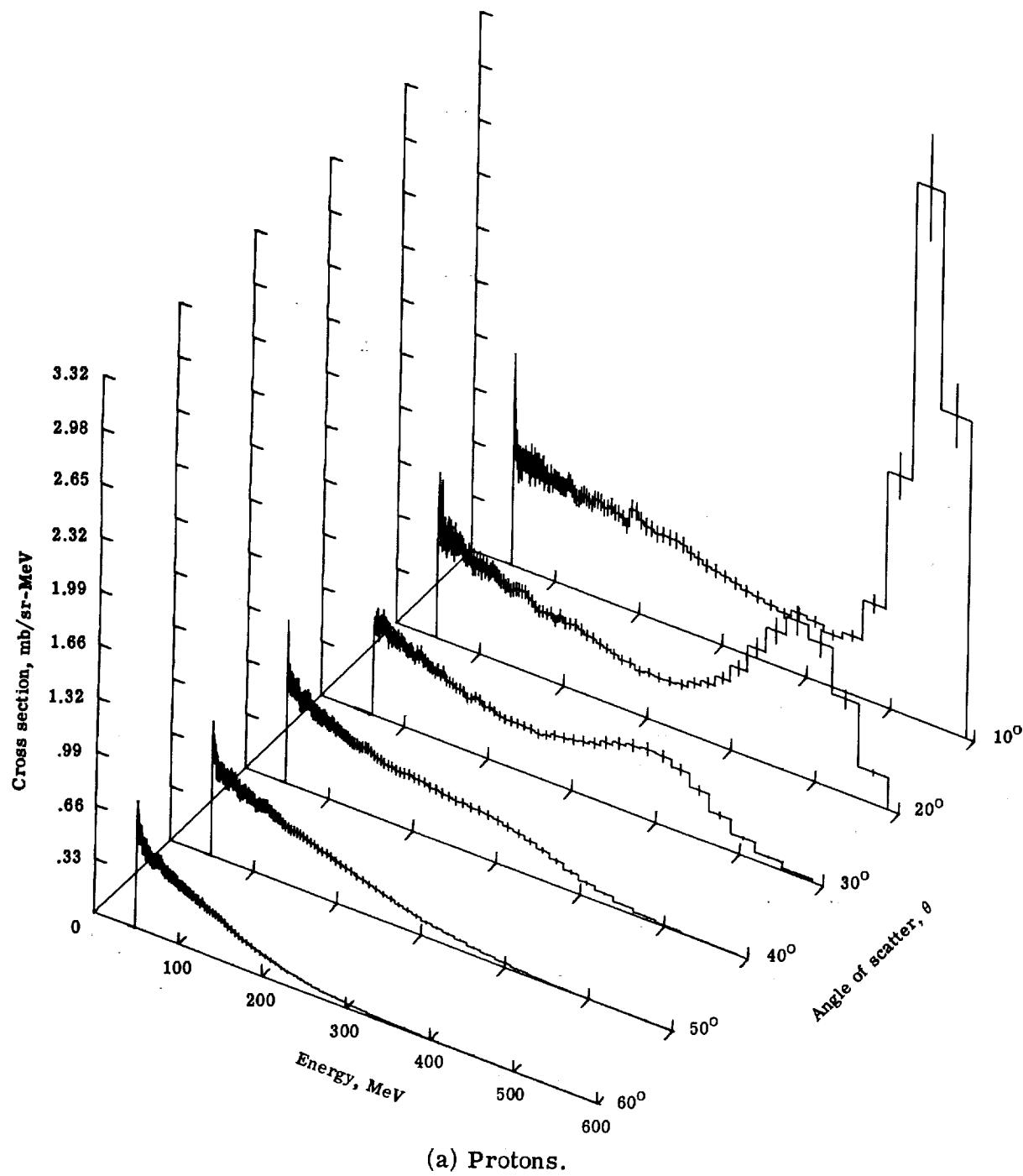
(a) Protons.

Figure 4.- Continuum spectra from carbon target,  $0.95 \text{ g/cm}^2$  thick.  
Incident proton energy,  $558 \pm 7 \text{ MeV}$ .

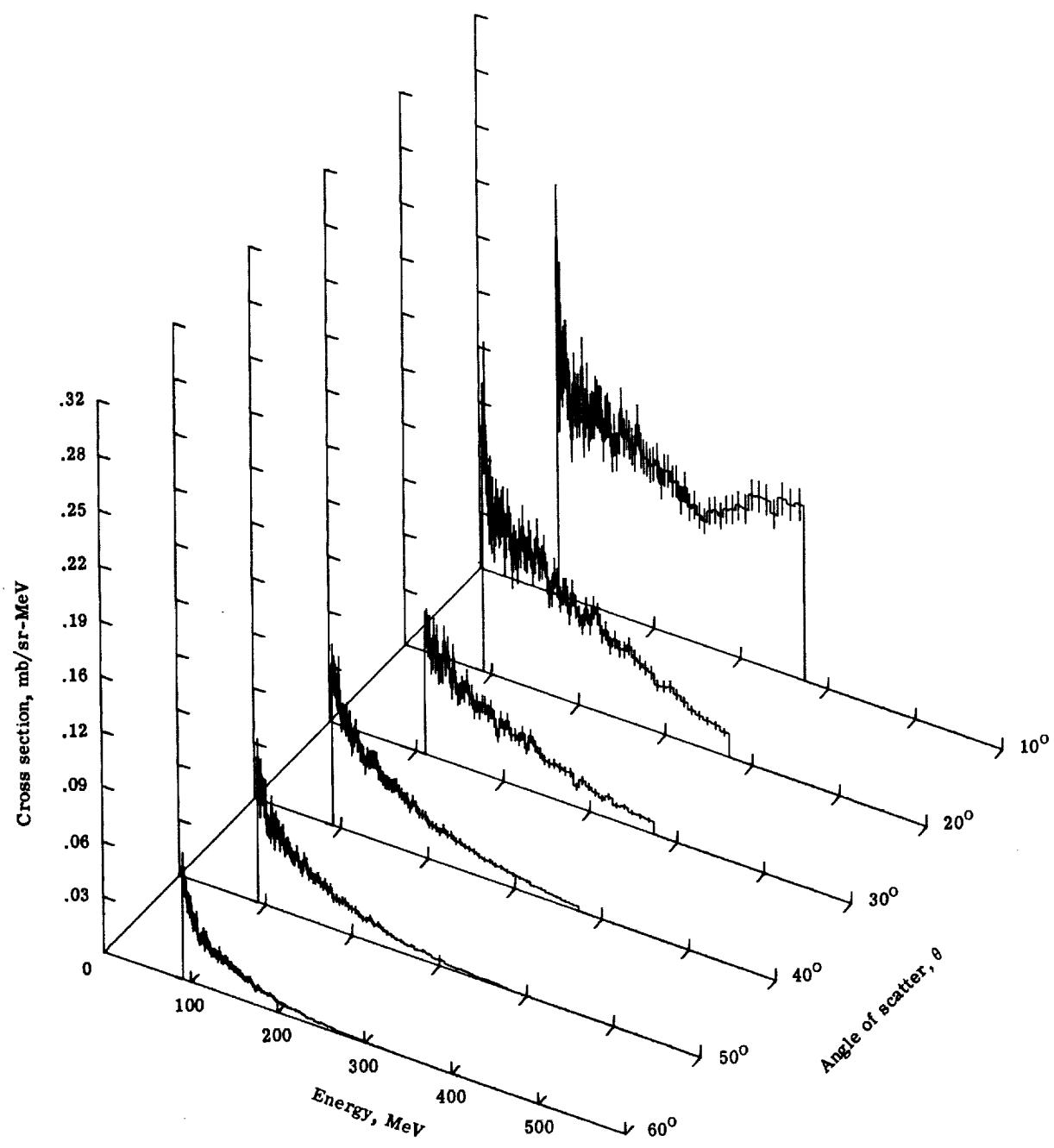


(b) Deuterons.

Figure 4.- Concluded.

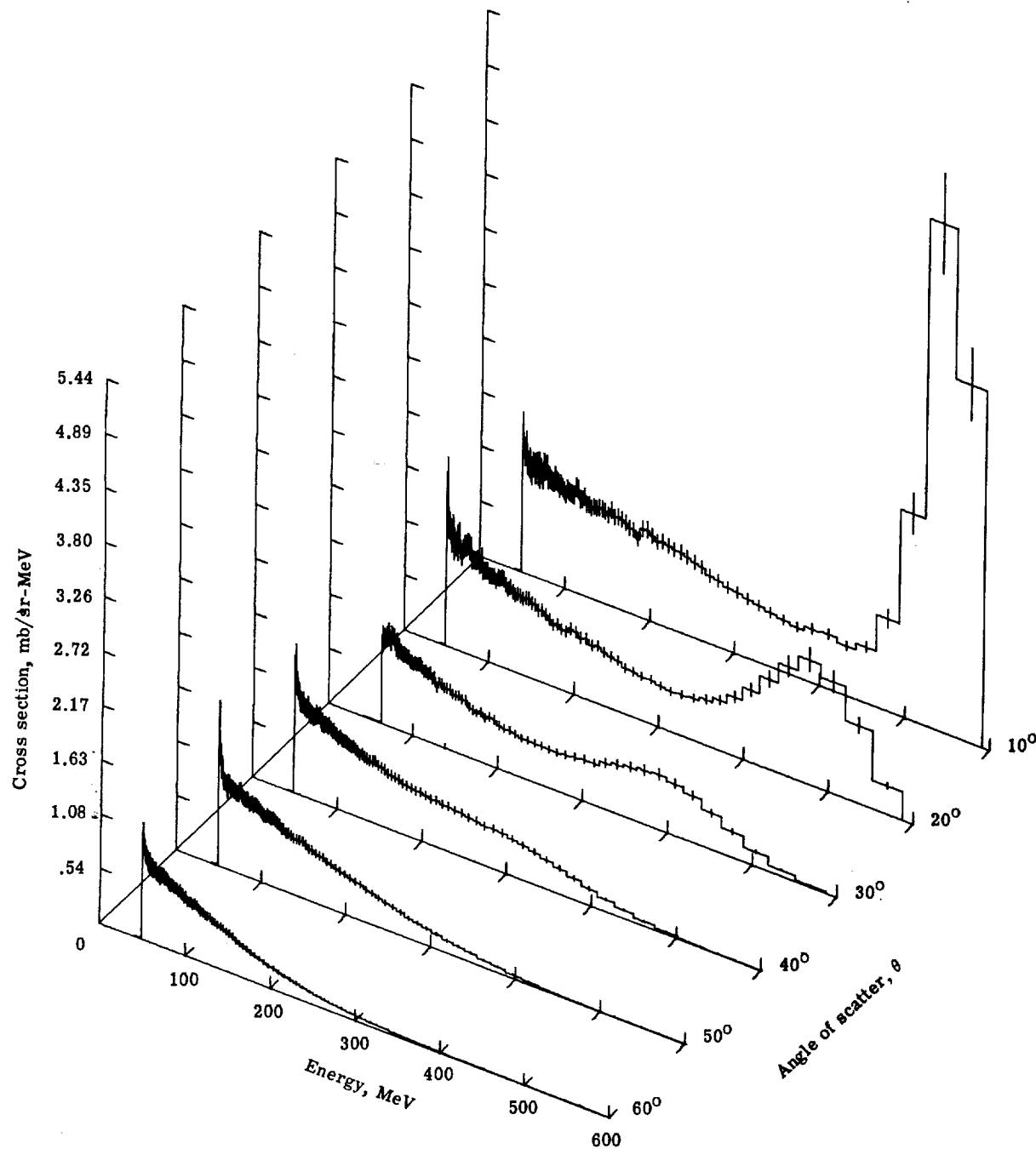


**Figure 5.-** Continuum spectra from aluminum target,  $1.82 \text{ g/cm}^2$  thick.  
Incident proton energy,  $558 \pm 7 \text{ MeV}$ .



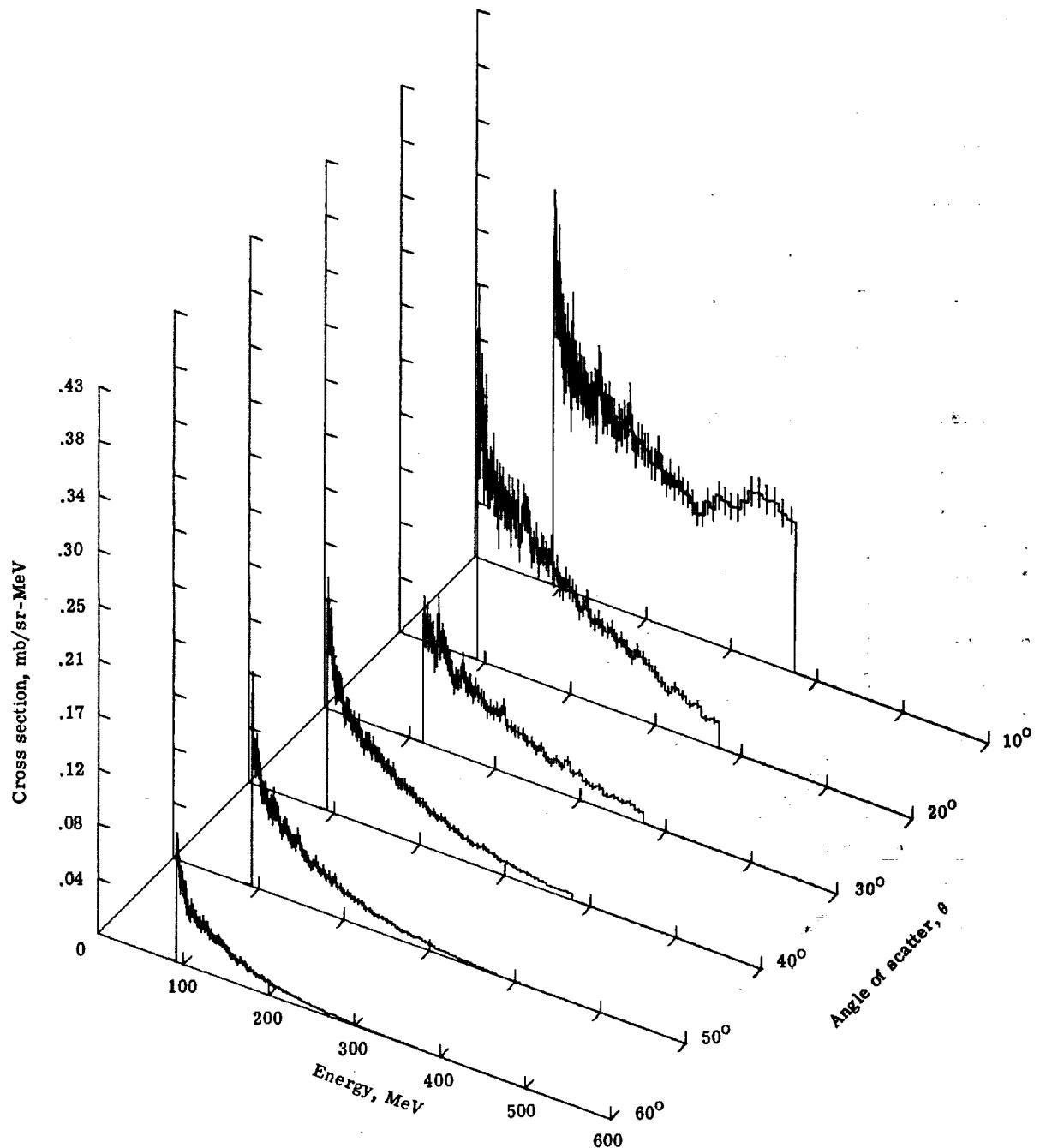
(b) Deuterons.

Figure 5.- Concluded.



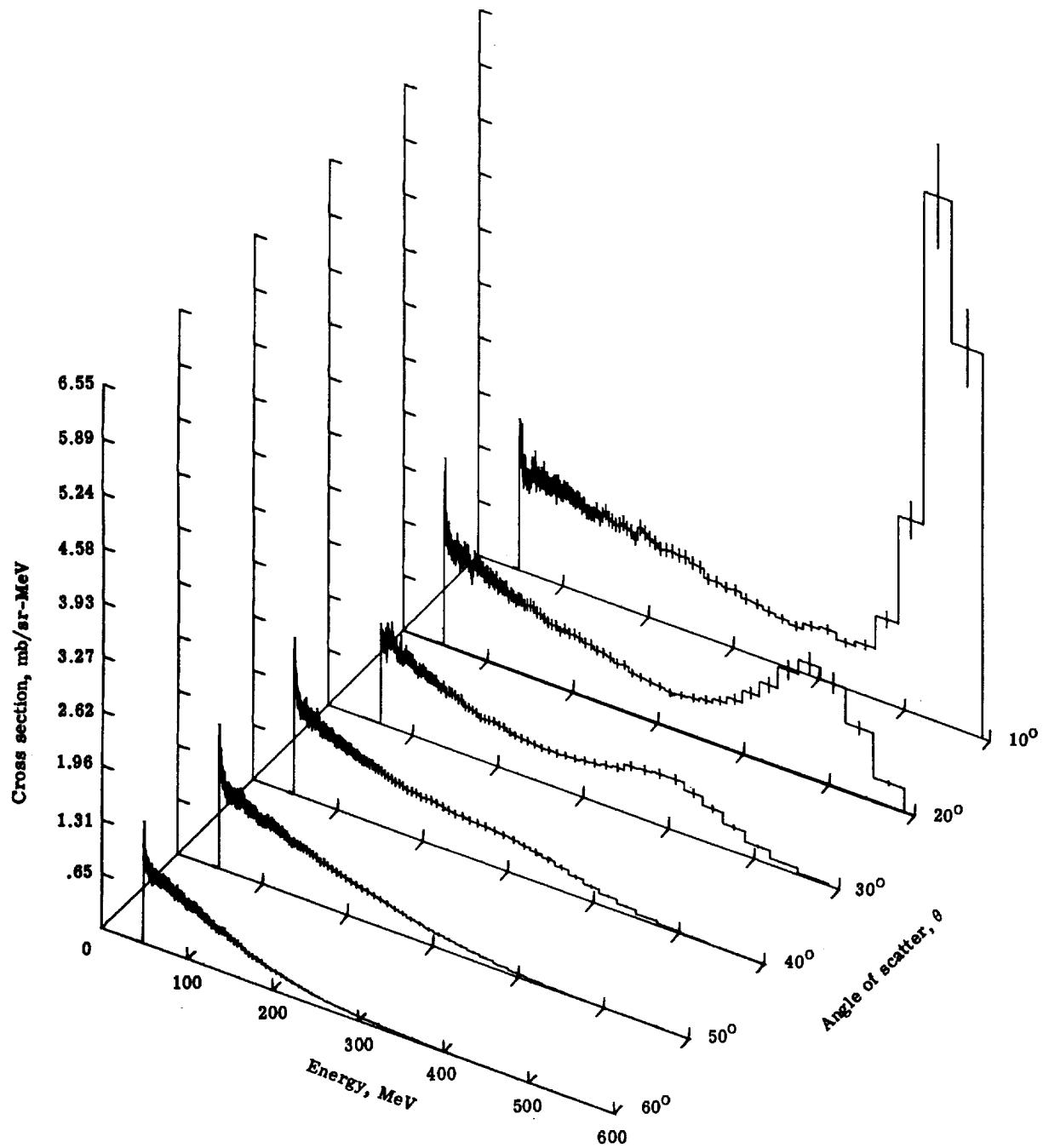
(a) Protons.

Figure 6.- Continuum spectra from iron target,  $3.77 \text{ g/cm}^2$  thick.  
Incident proton energy,  $558 \pm 7 \text{ MeV}$ .



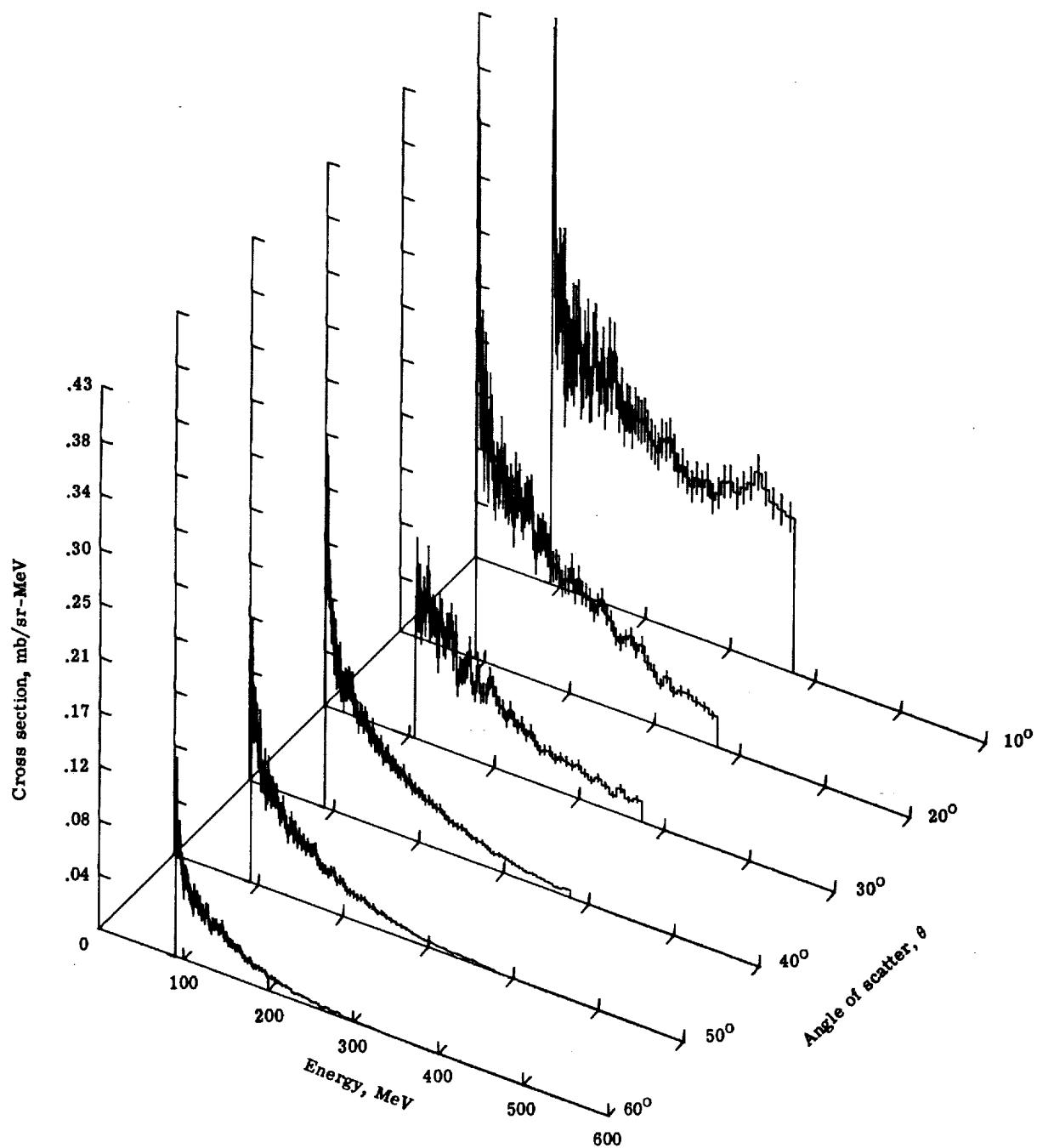
(b) Deuterons.

Figure 6.- Concluded.



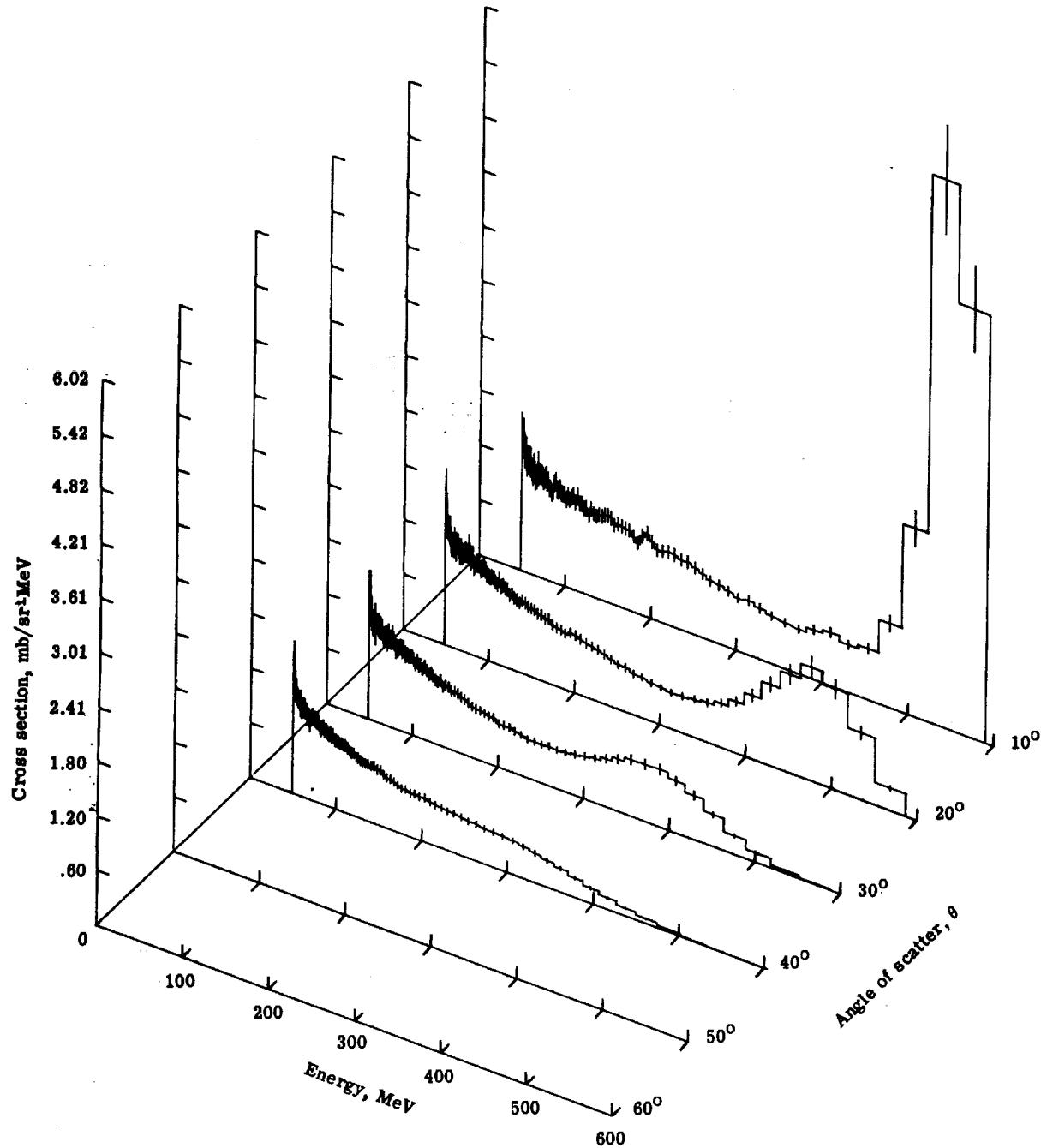
(a) Protons.

**Figure 7.-** Continuum spectra from copper target,  $2.79 \text{ g/cm}^2$  thick.  
Incident proton energy,  $558 \pm 7 \text{ MeV}$ .



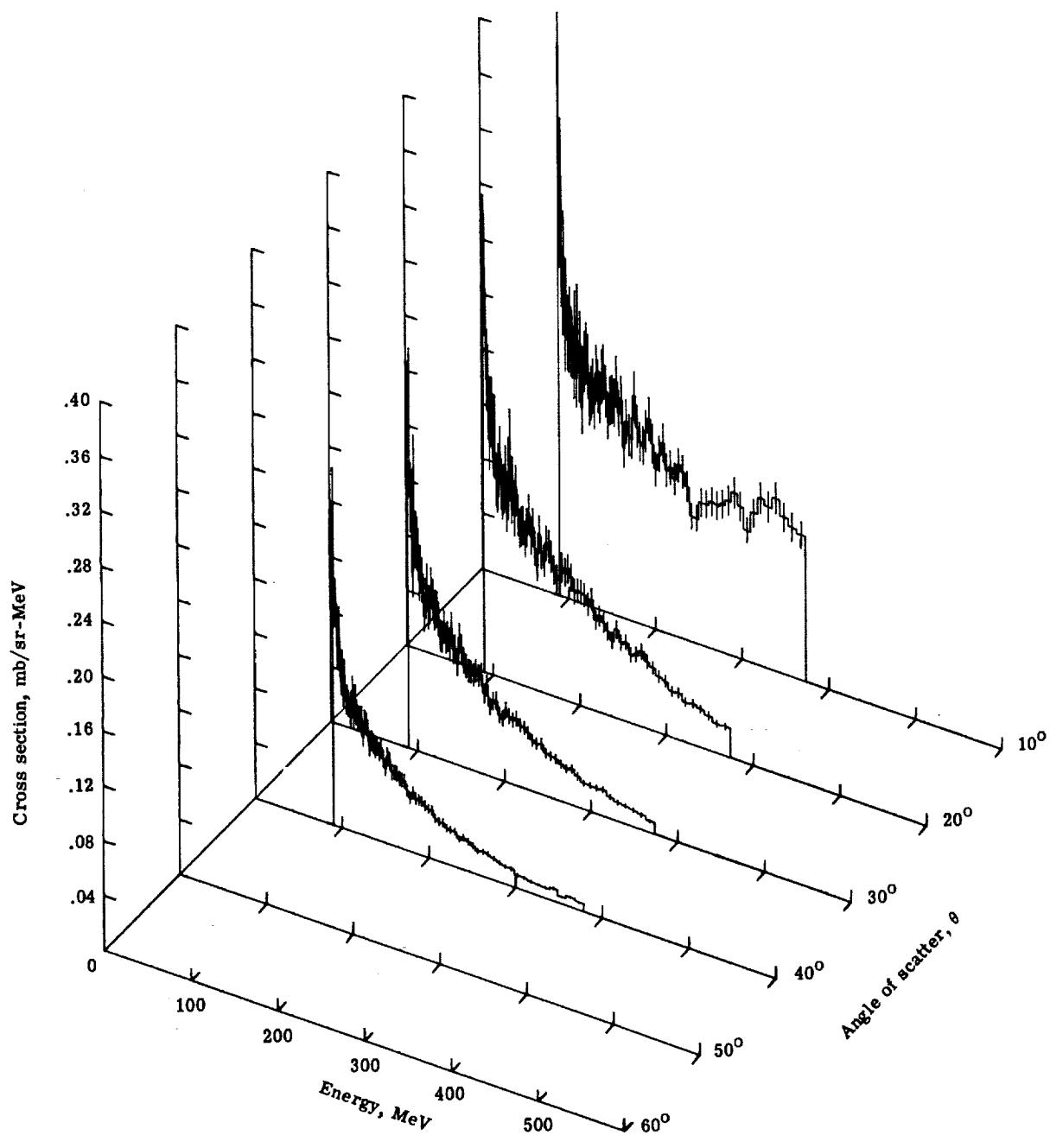
(b) Deuterons.

Figure 7.- Concluded.



(a) Protons.

Figure 8.- Continuum spectra from germanium target, 5.26 g/cm<sup>2</sup> thick.  
Incident proton energy, 558 ± 7 MeV.



(b) Deuterons.

Figure 8.- Concluded.

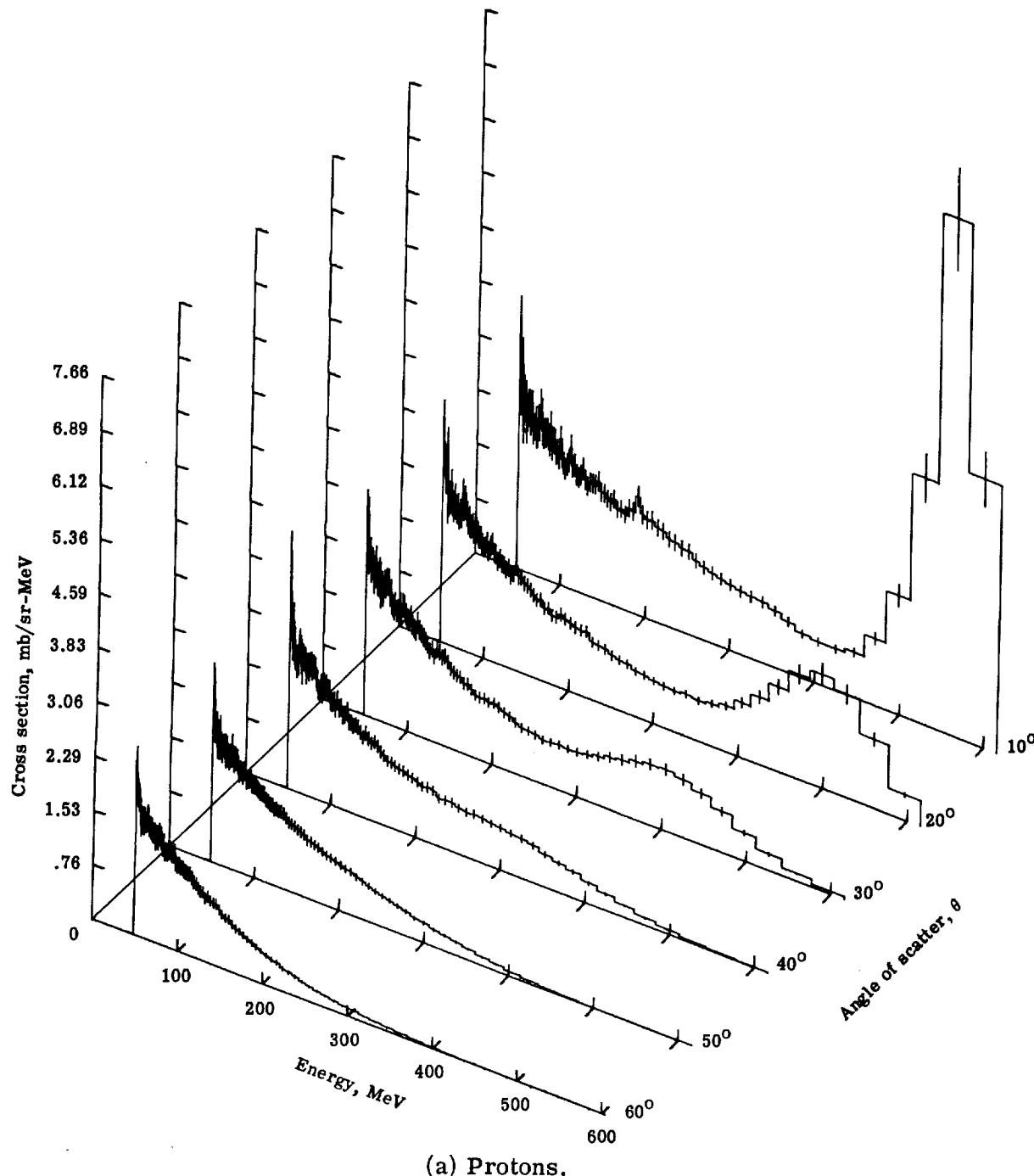
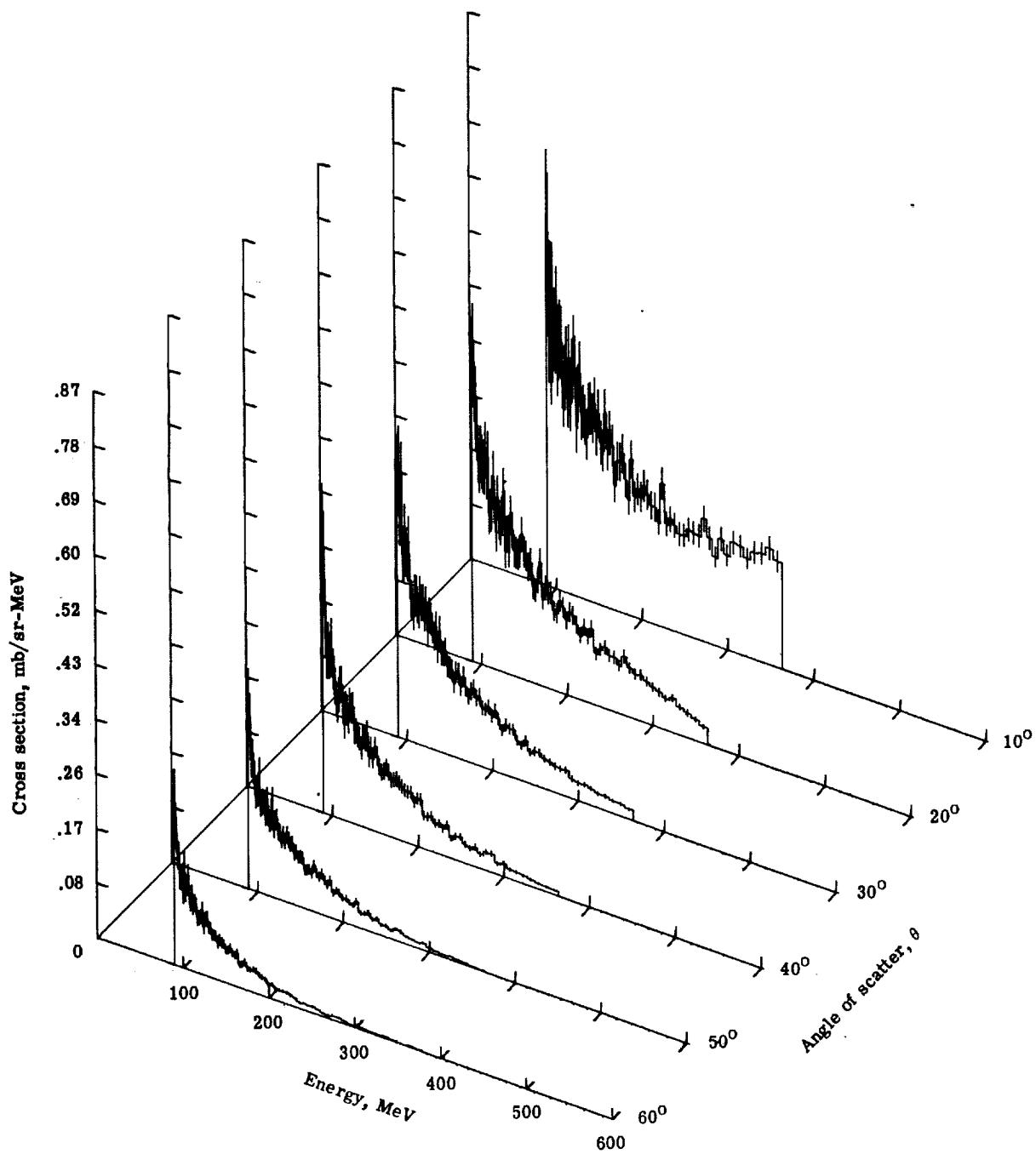
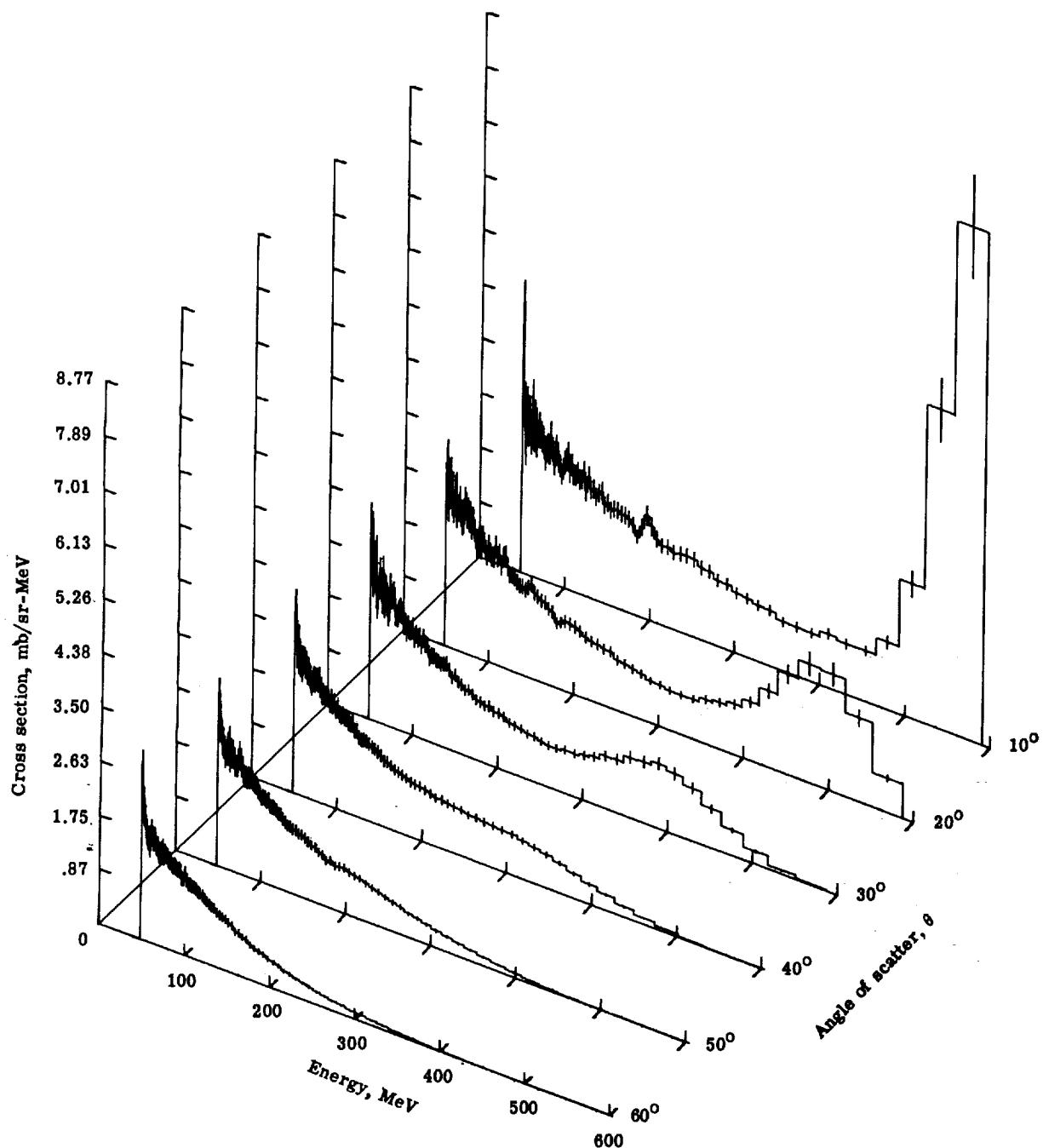


Figure 9.- Continuum spectra from tungsten target,  $3.05 \text{ g/cm}^2$  thick.  
Incident proton energy,  $558 \pm 7 \text{ MeV}$ .



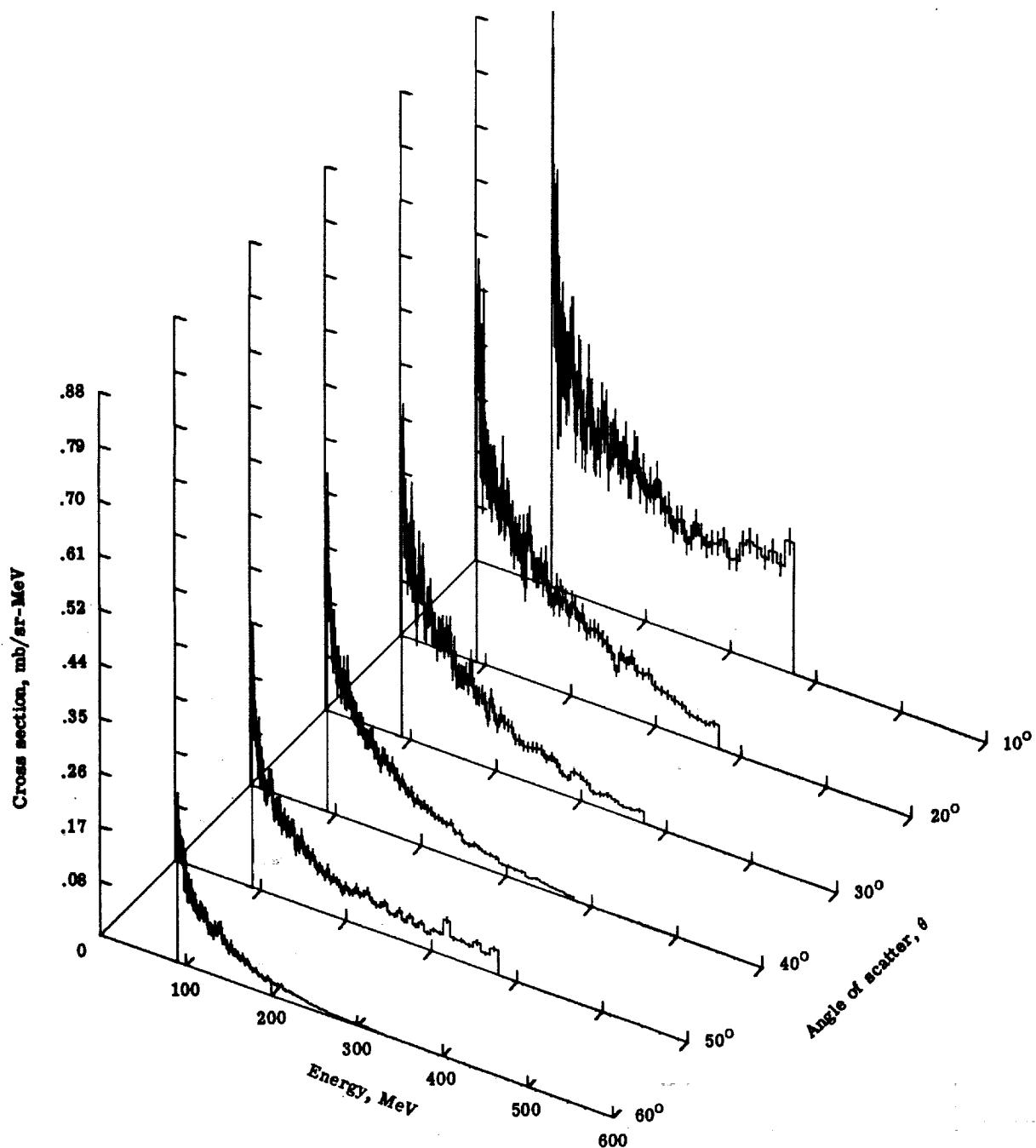
(b) Deuterons.

Figure 9.- Concluded.



(a) Protons.

Figure 10.- Continuum spectra from lead target,  $3.91 \text{ g/cm}^2$  thick.  
Incident proton energy,  $558 \pm 7 \text{ MeV}$ .



(b) Deuterons.

Figure 10.- Concluded.

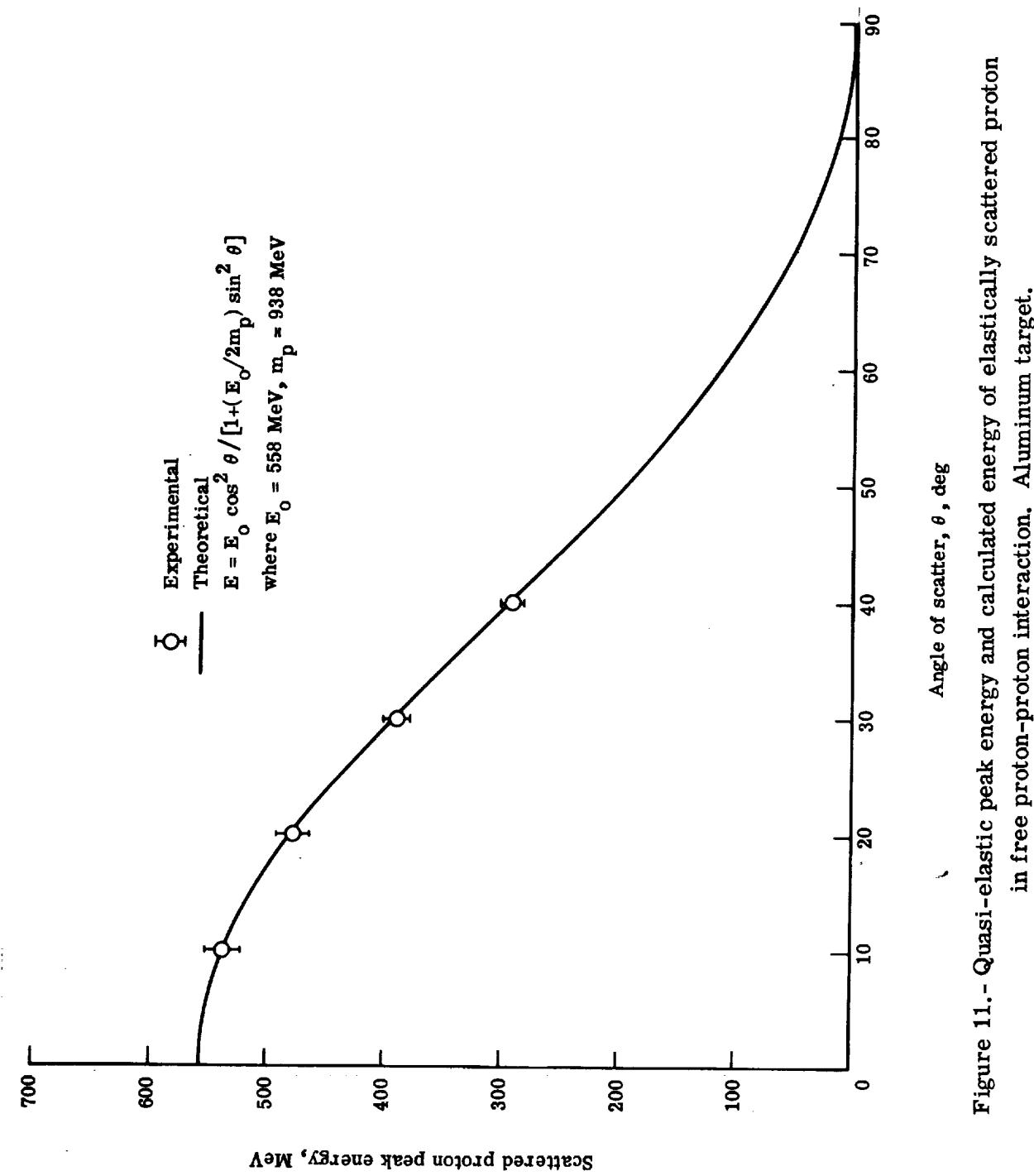


Figure 11.- Quasi-elastic peak energy and calculated energy of elastically scattered proton in free proton-proton interaction. Aluminum target.

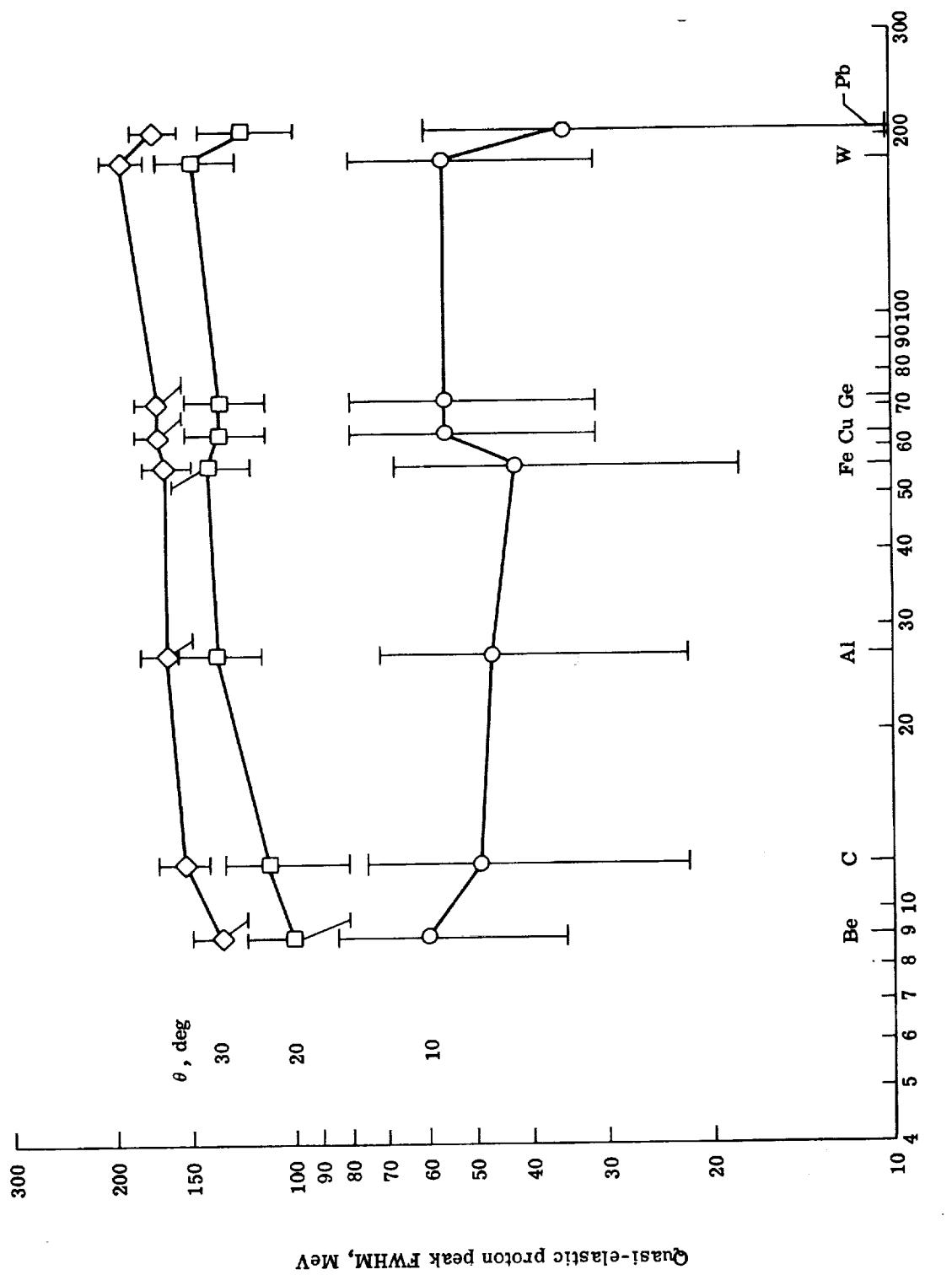


Figure 12.- Quasi-elastic proton peak full width at half maximum. (FWHM) as a function of target mass number. Solid lines are a guide only.

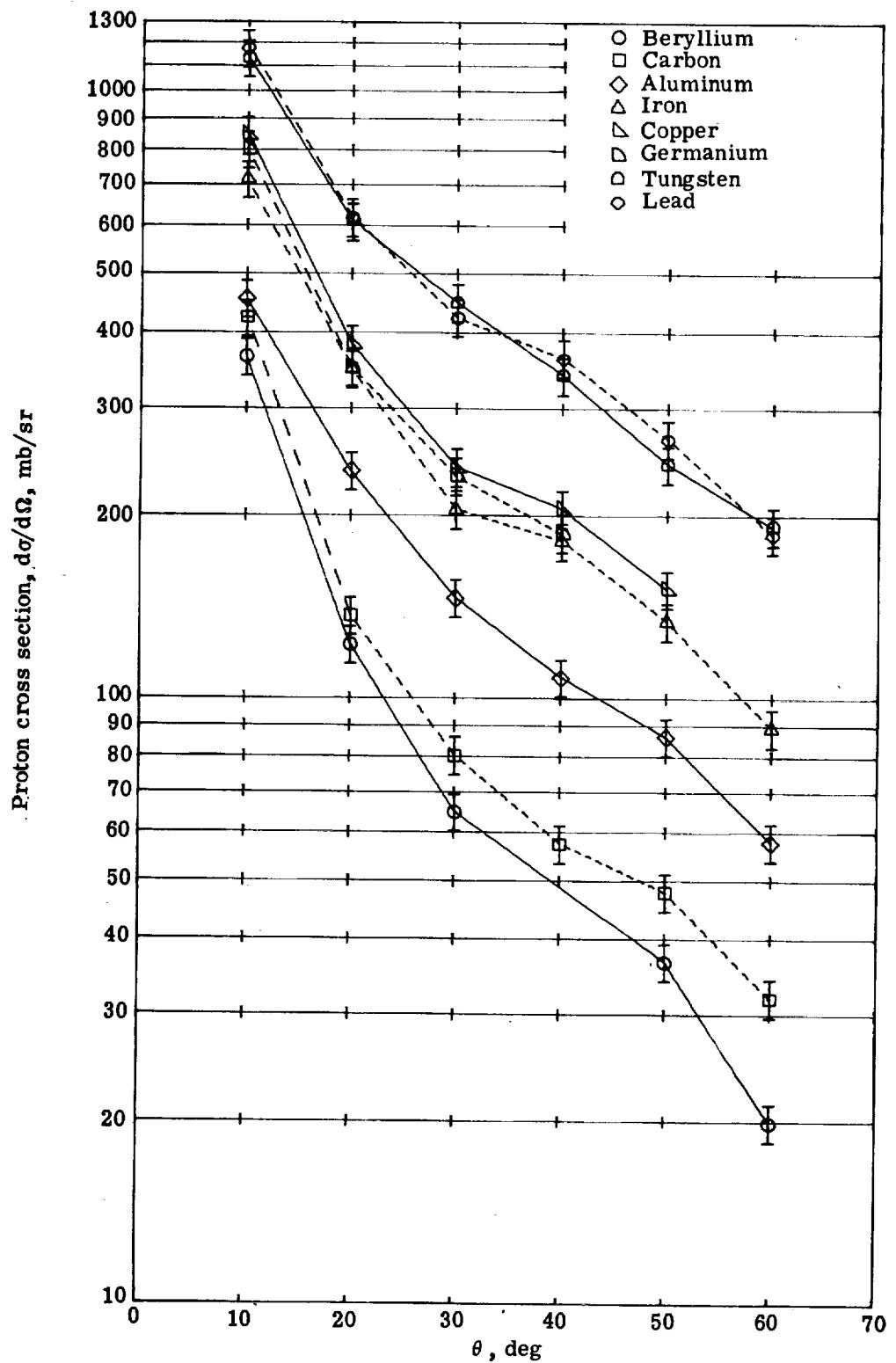


Figure 13.- Angular variations of energy-integrated proton cross sections.

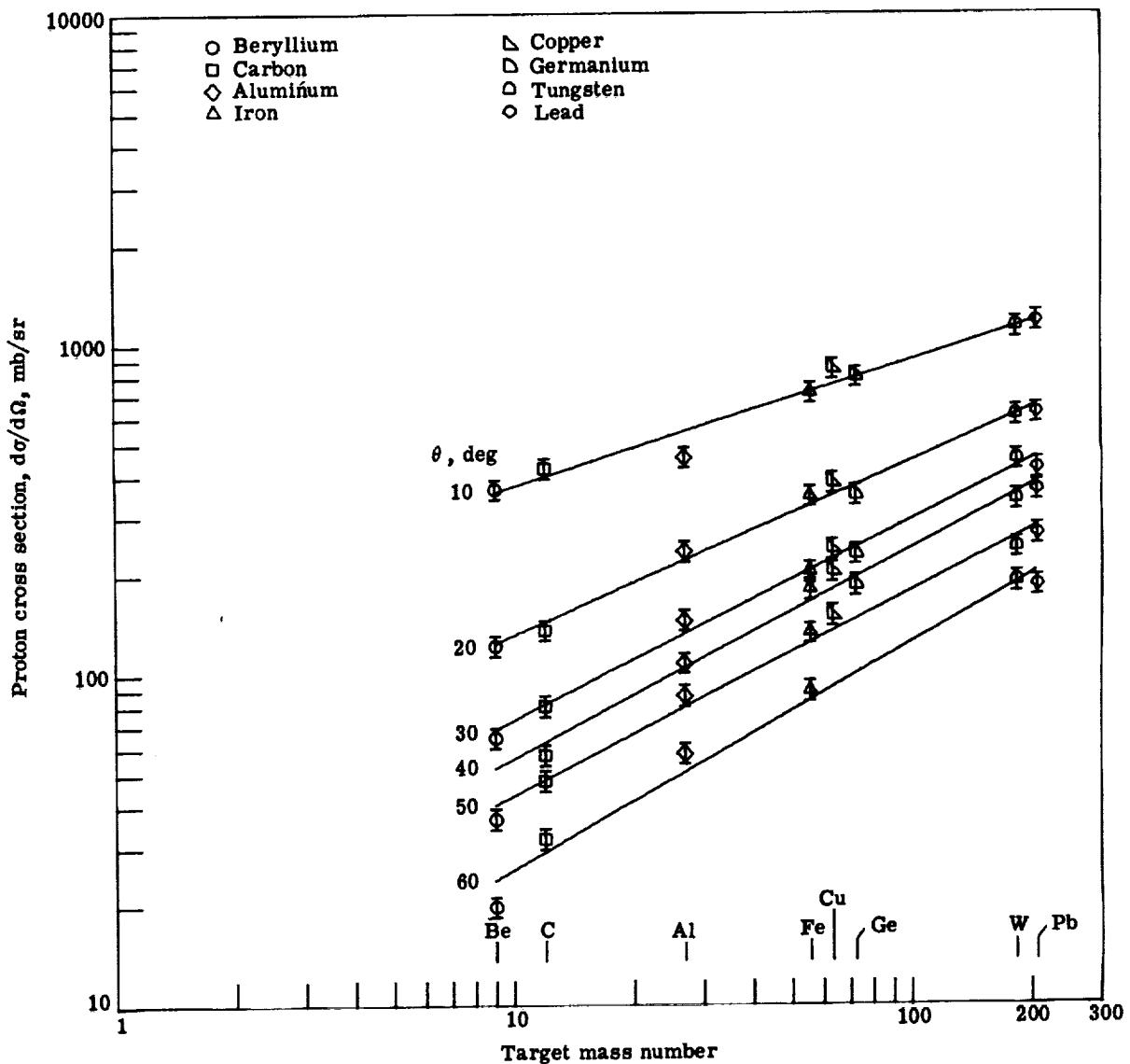


Figure 14.- Variation of energy-integrated proton cross sections with target mass number.

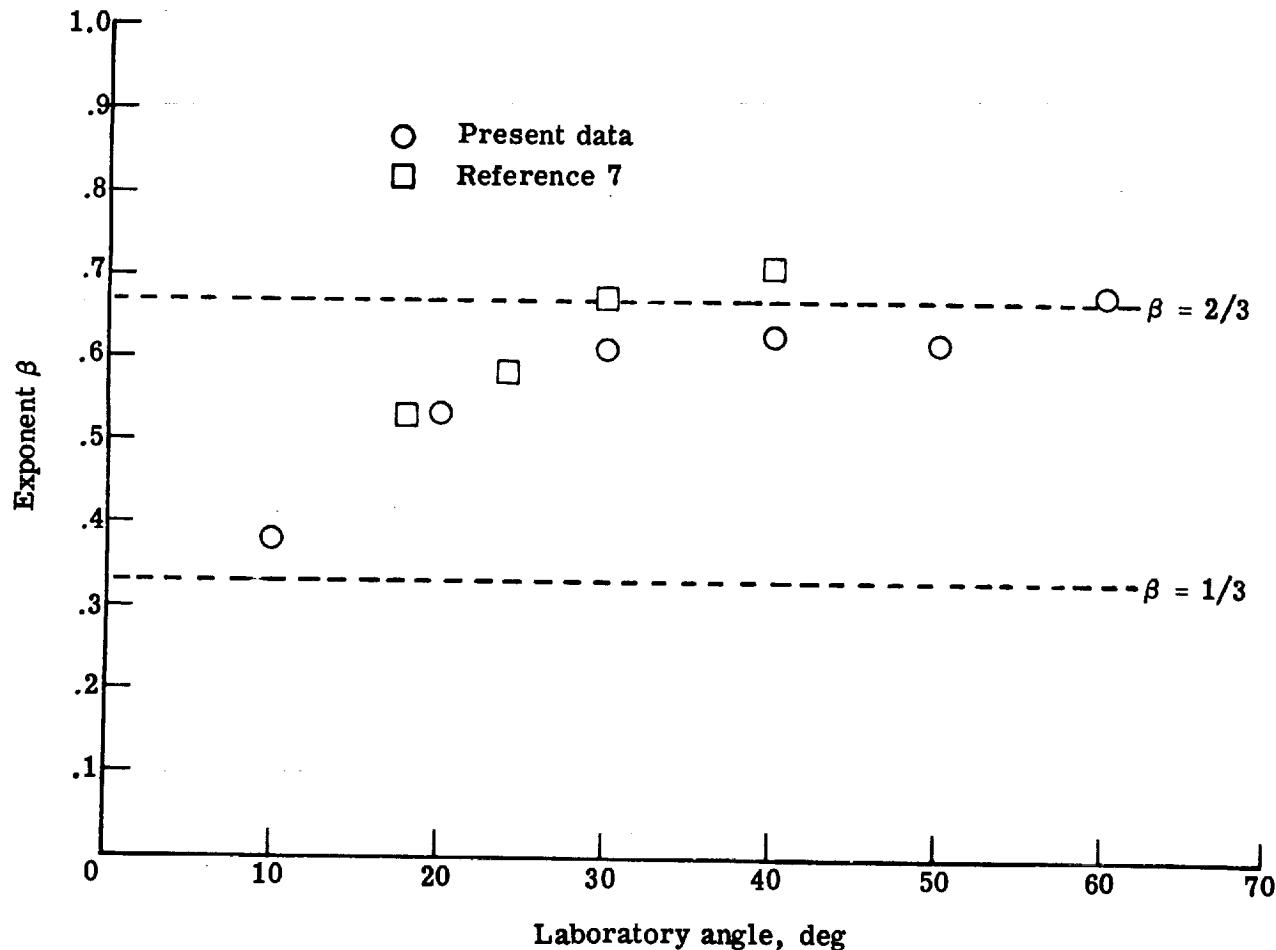


Figure 15.- Dependence of energy-integrated proton cross sections on exponent  $\beta$  as a function of laboratory angle of scatter.

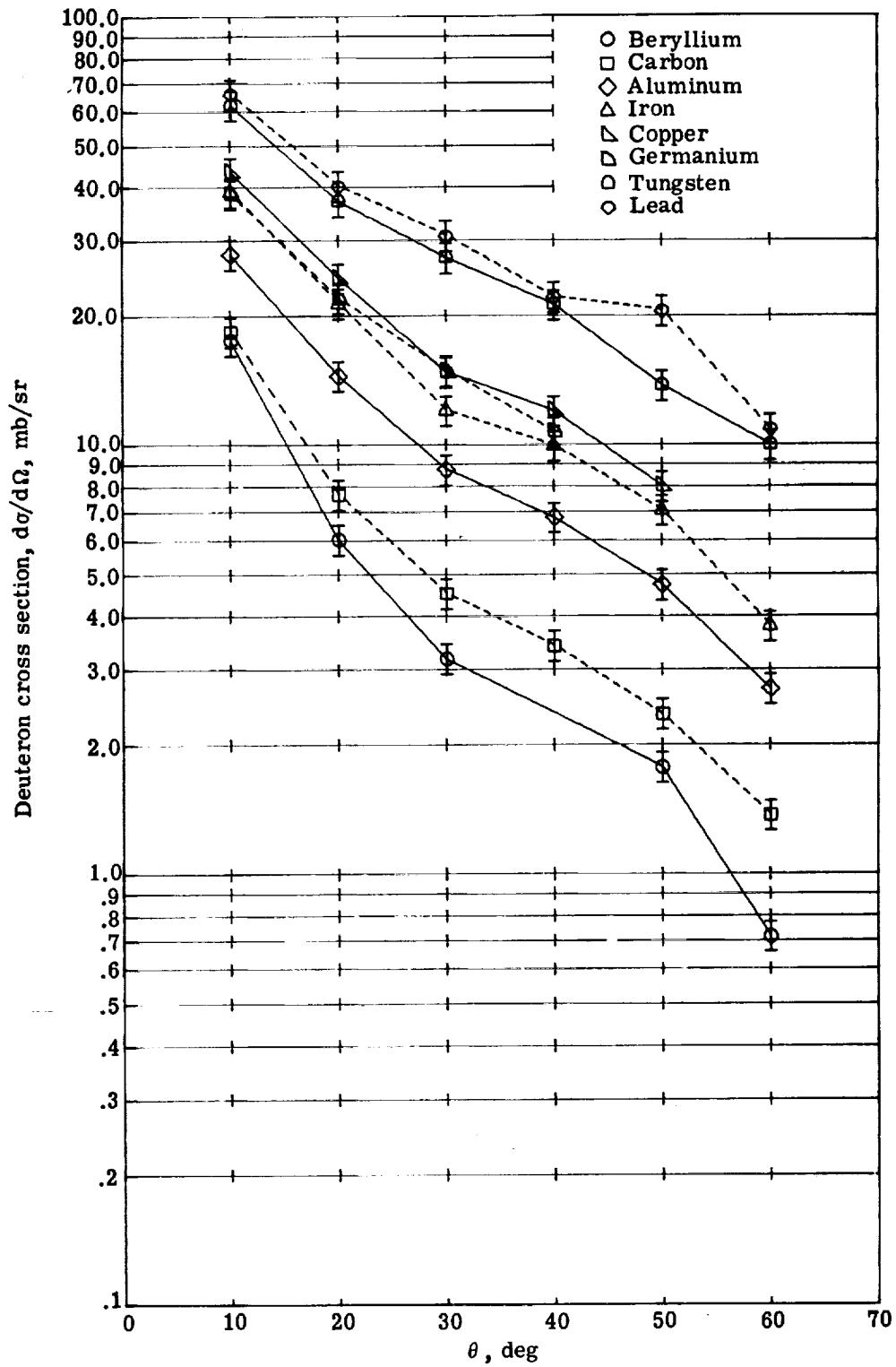


Figure 16.- Angular variation of energy-integrated deuteron cross sections.

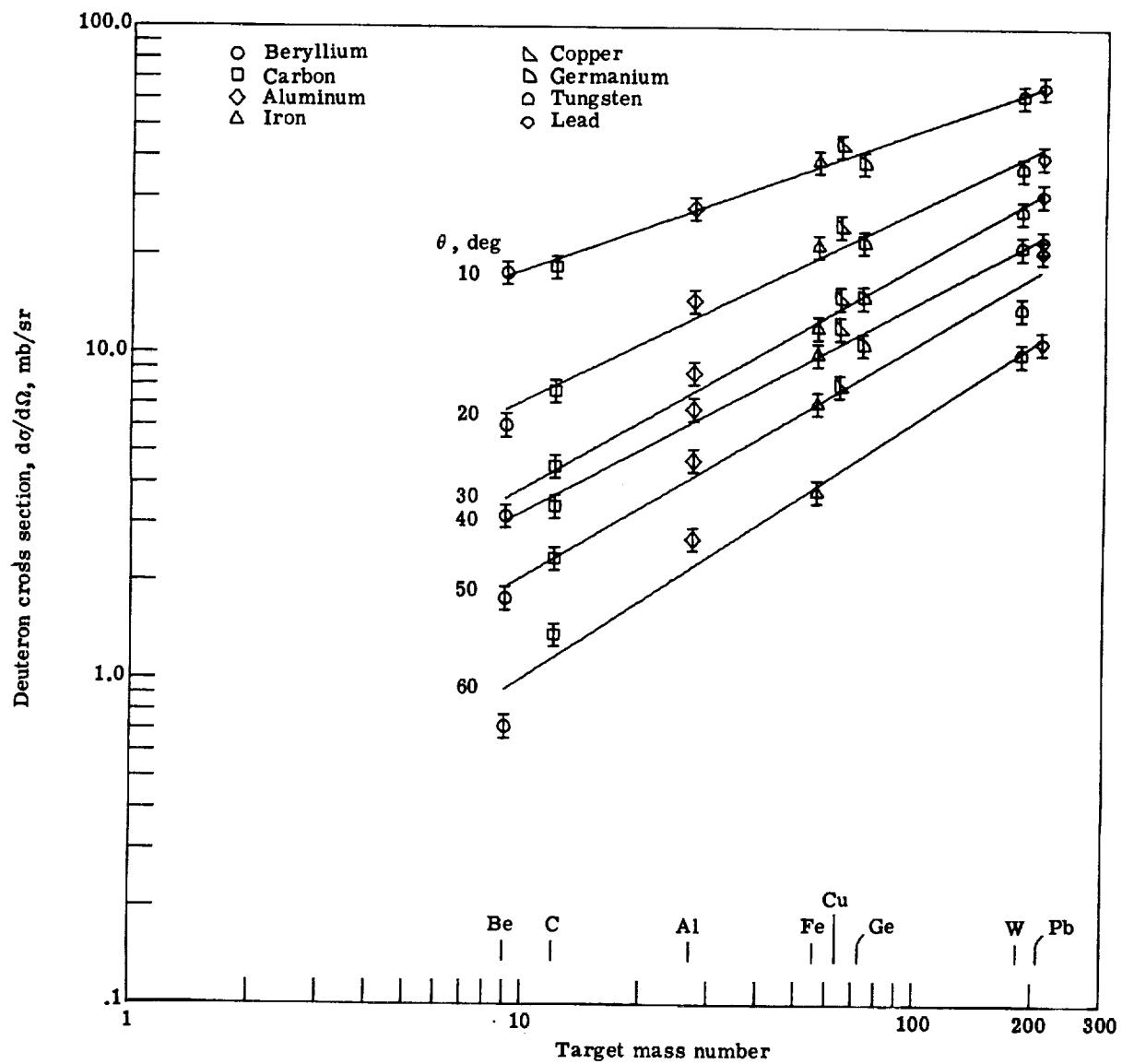


Figure 17.- Variation of energy-integrated deuteron cross sections with target mass number.

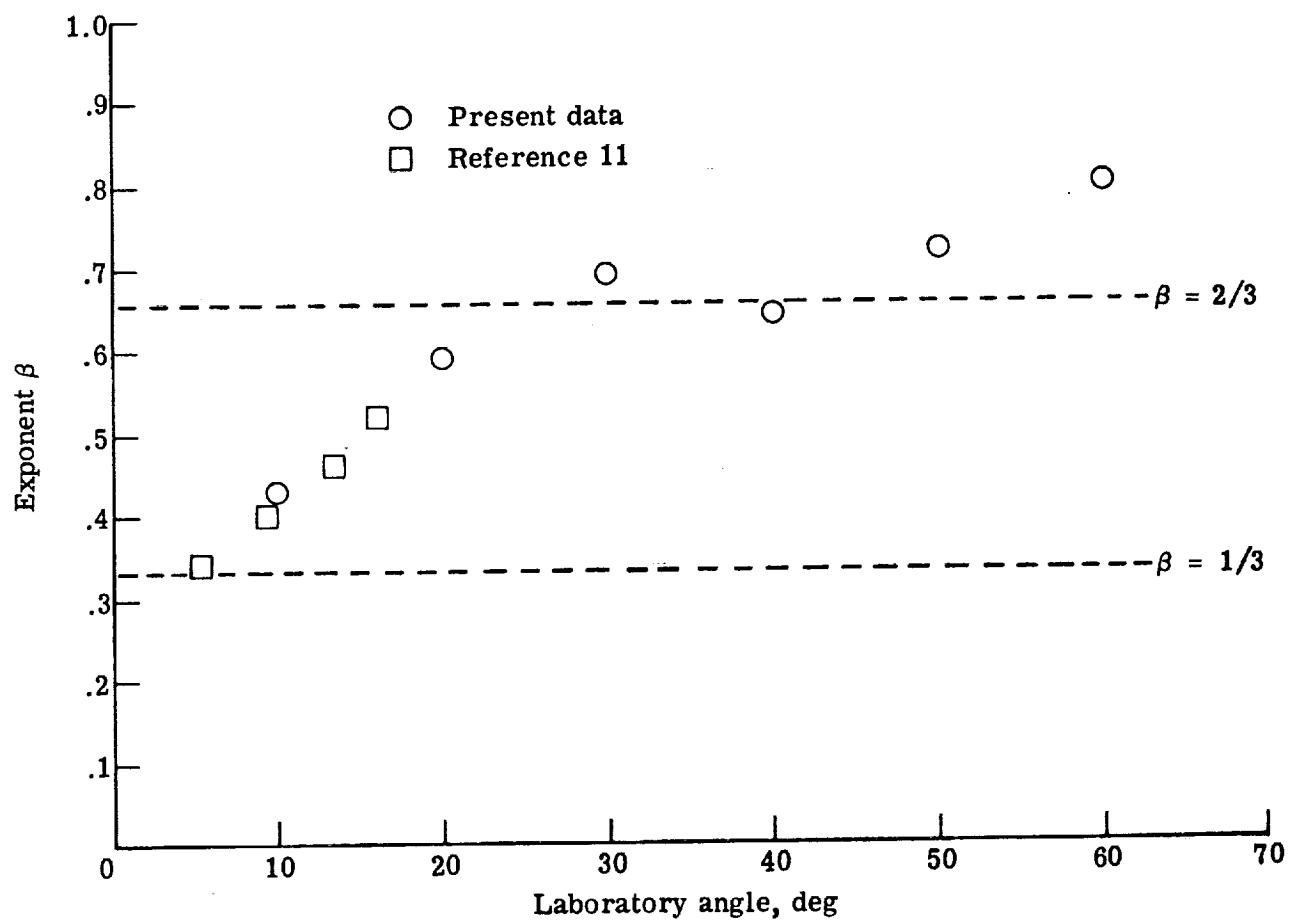
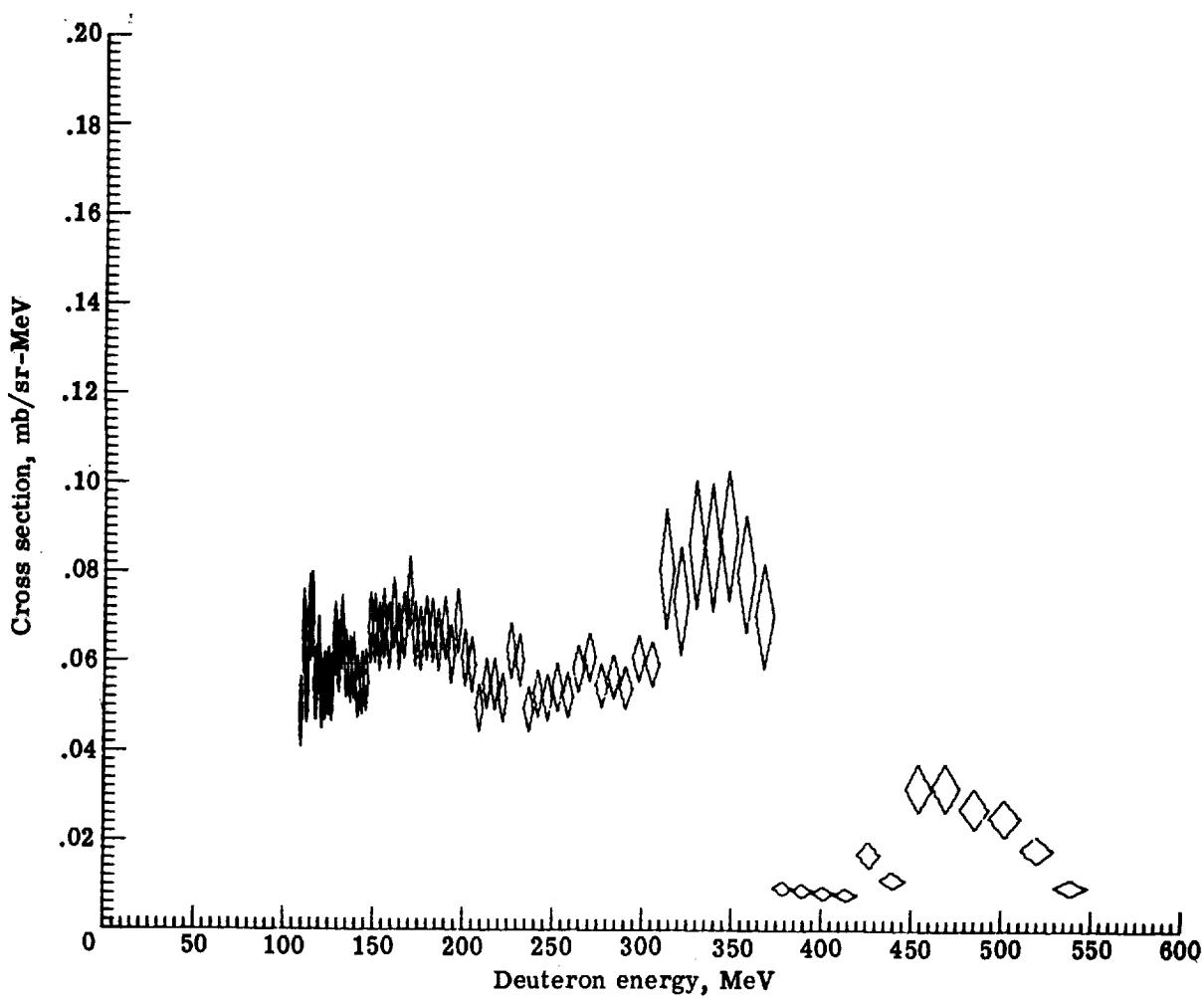
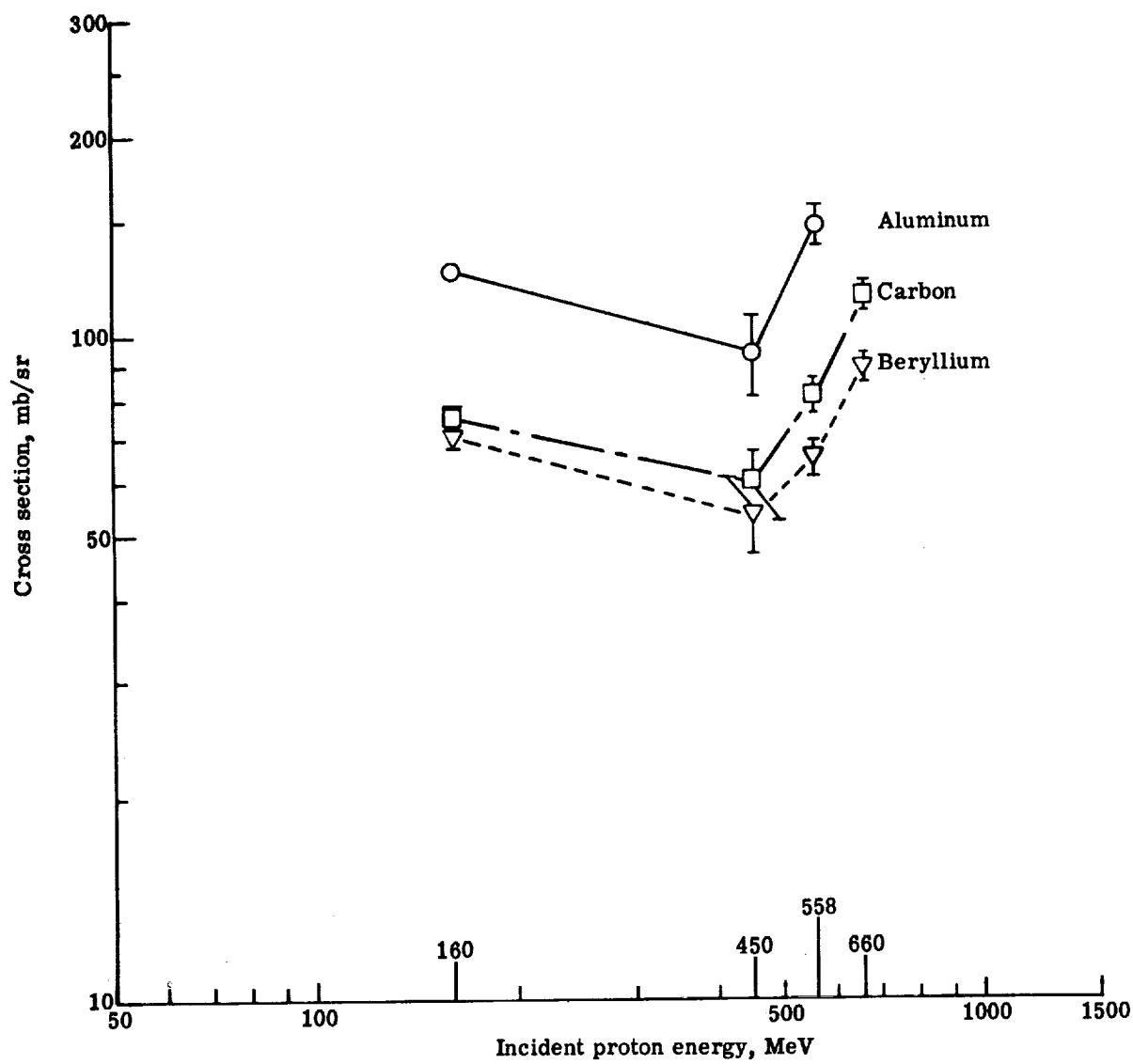


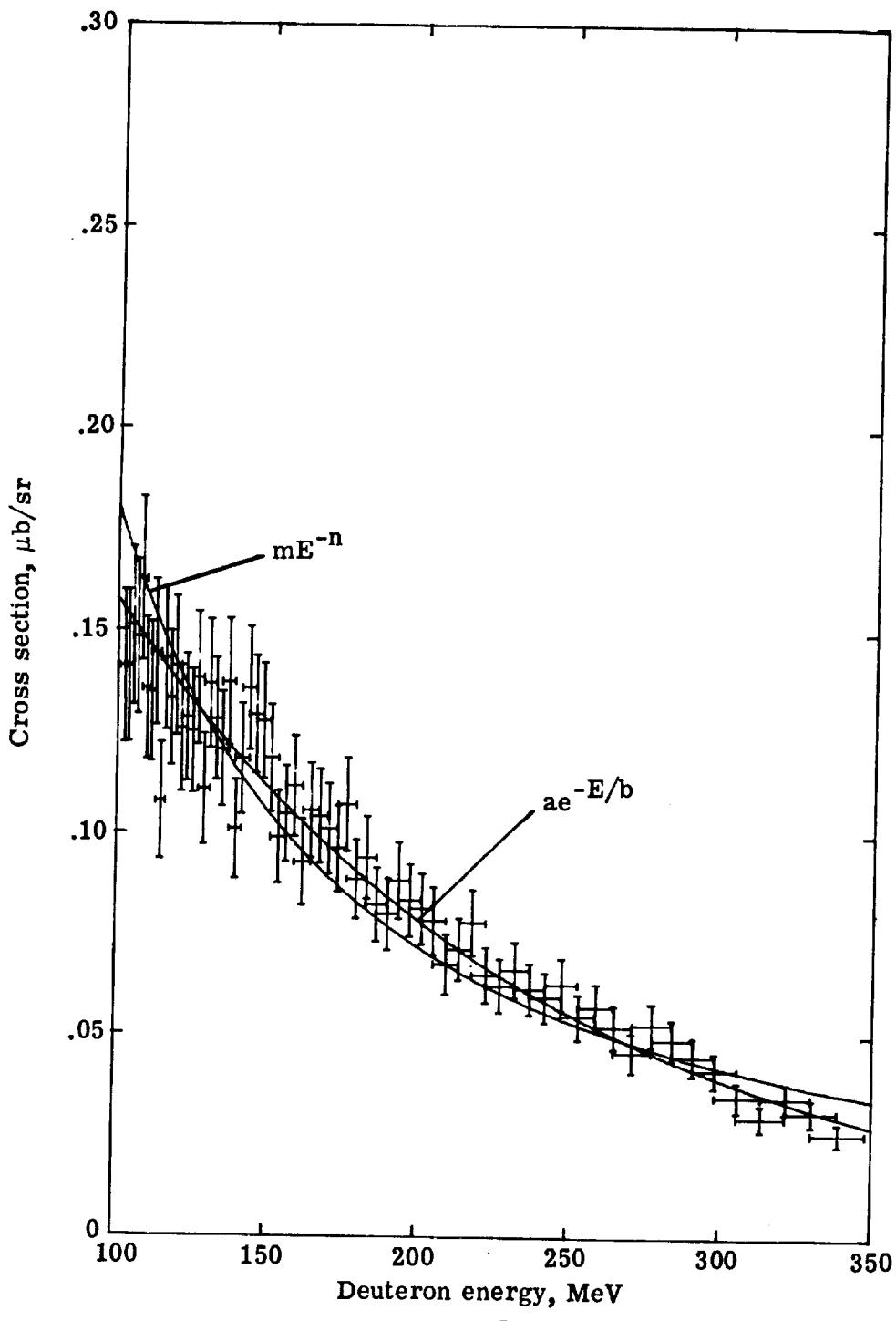
Figure 18.- Dependence of energy-integrated deuteron cross sections on exponent  $\beta$  as a function of laboratory angle of scatter.



**Figure 19.- Experimental cross sections for quasi-elastic deuteron production.**  
Beryllium target,  $2.35 \text{ g/cm}^2$  thick;  $\theta = 10^\circ$ ; 558-MeV incident protons.



**Figure 20.- Variation of energy-integrated proton cross section with incident proton energy.  $\theta = 30^\circ$ .**



(a)  $\theta = 20^\circ$ .

Figure 21.- Energy dependence of secondary deuteron cross section from iron target,  $3.77 \text{ g/cm}^2$  thick. The power-law curve  $mE^{-n}$  and the exponential curve  $ae^{-E/b}$  were fitted to data by method of least squares. See table 9(b) for values of parameters.

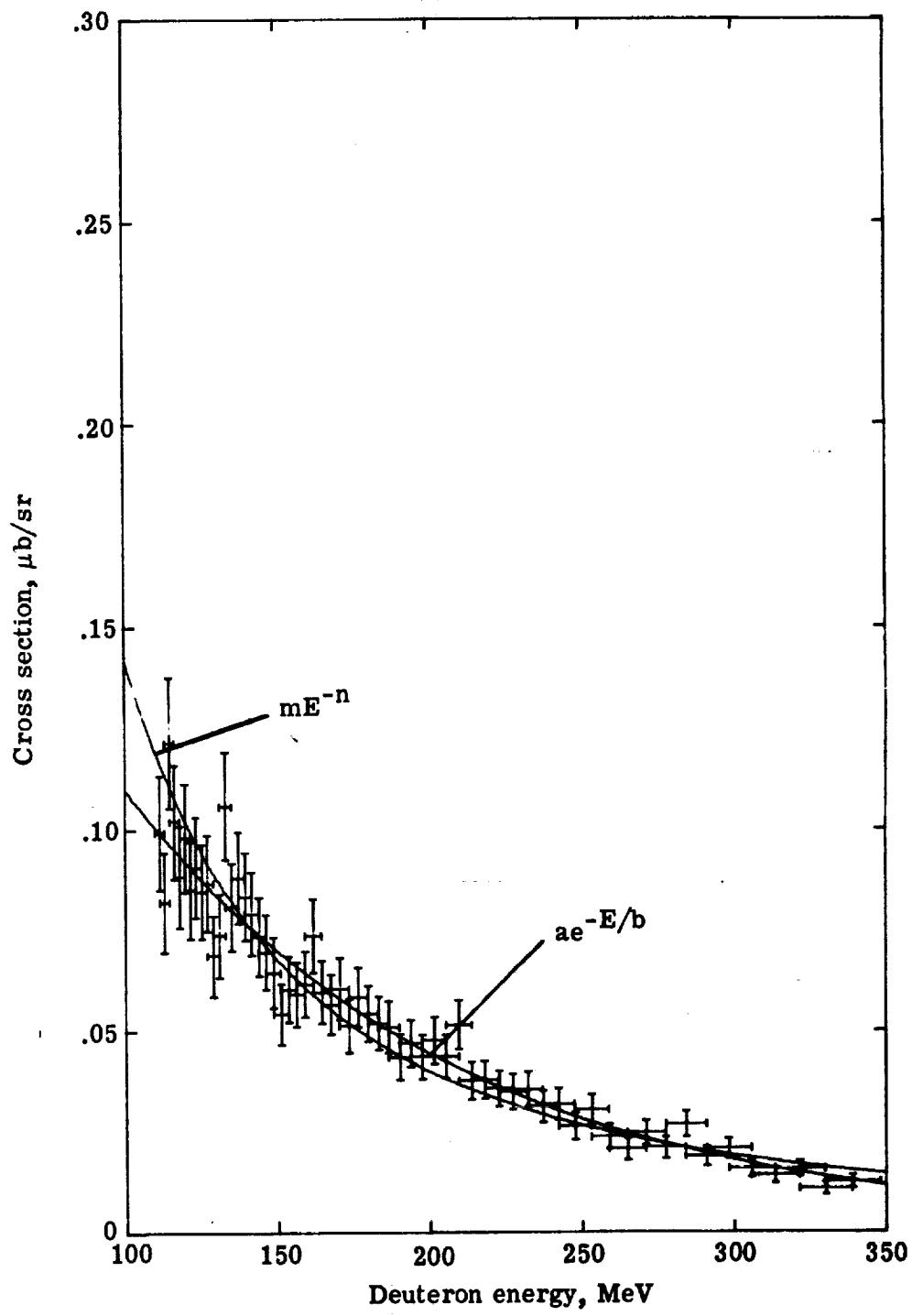


Figure 21.- Continued.

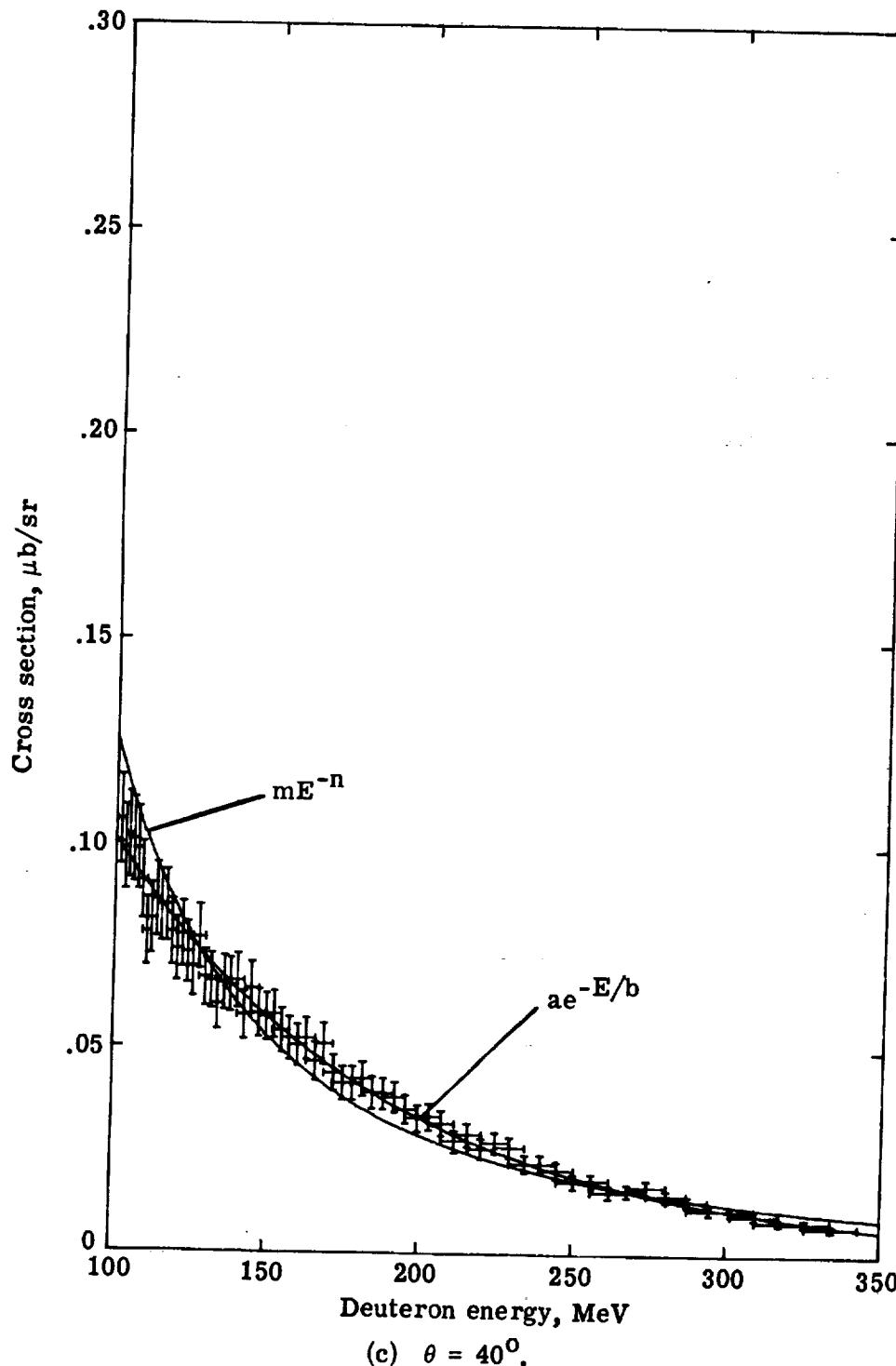


Figure 21.- Continued.

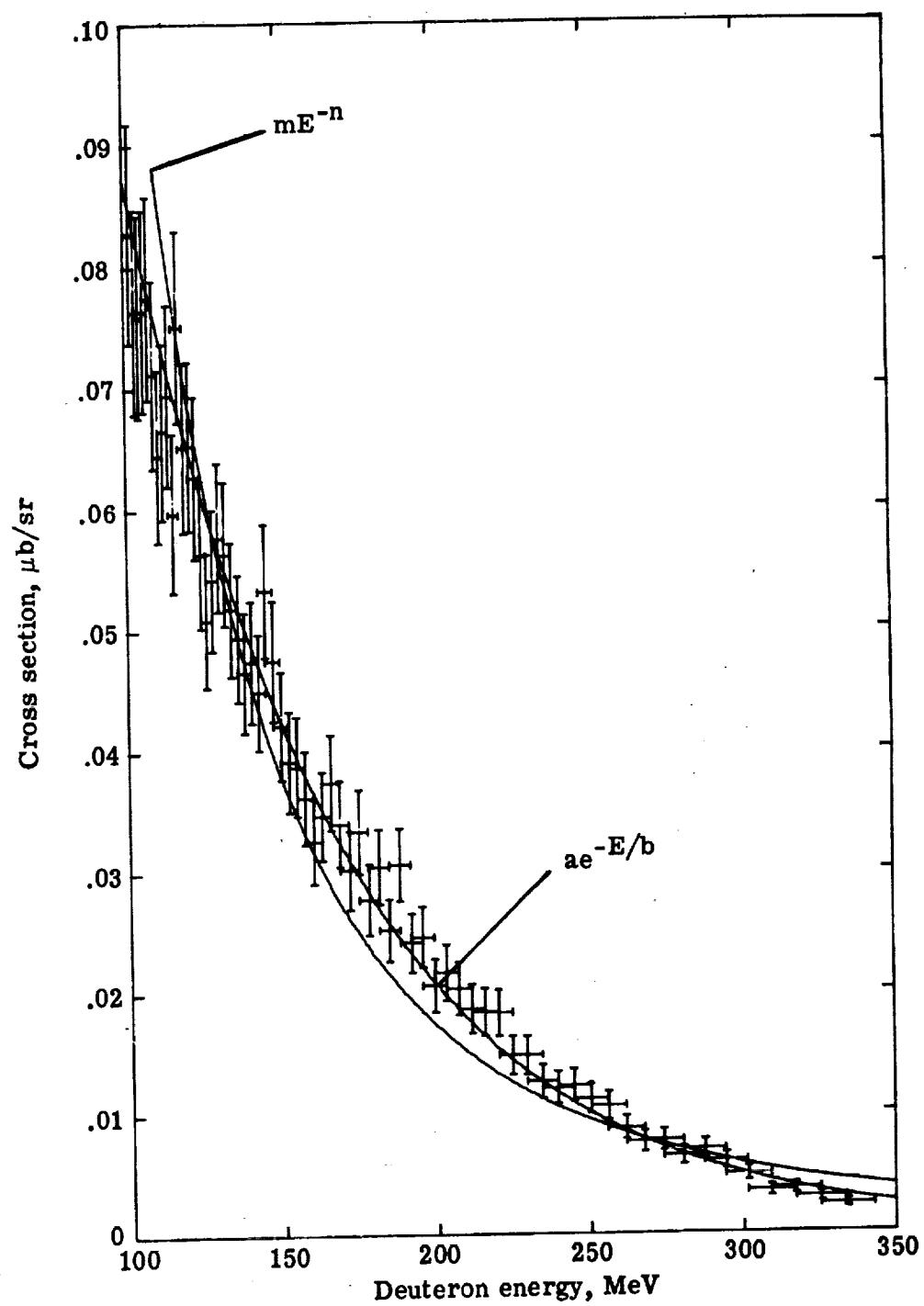


Figure 21.- Continued.

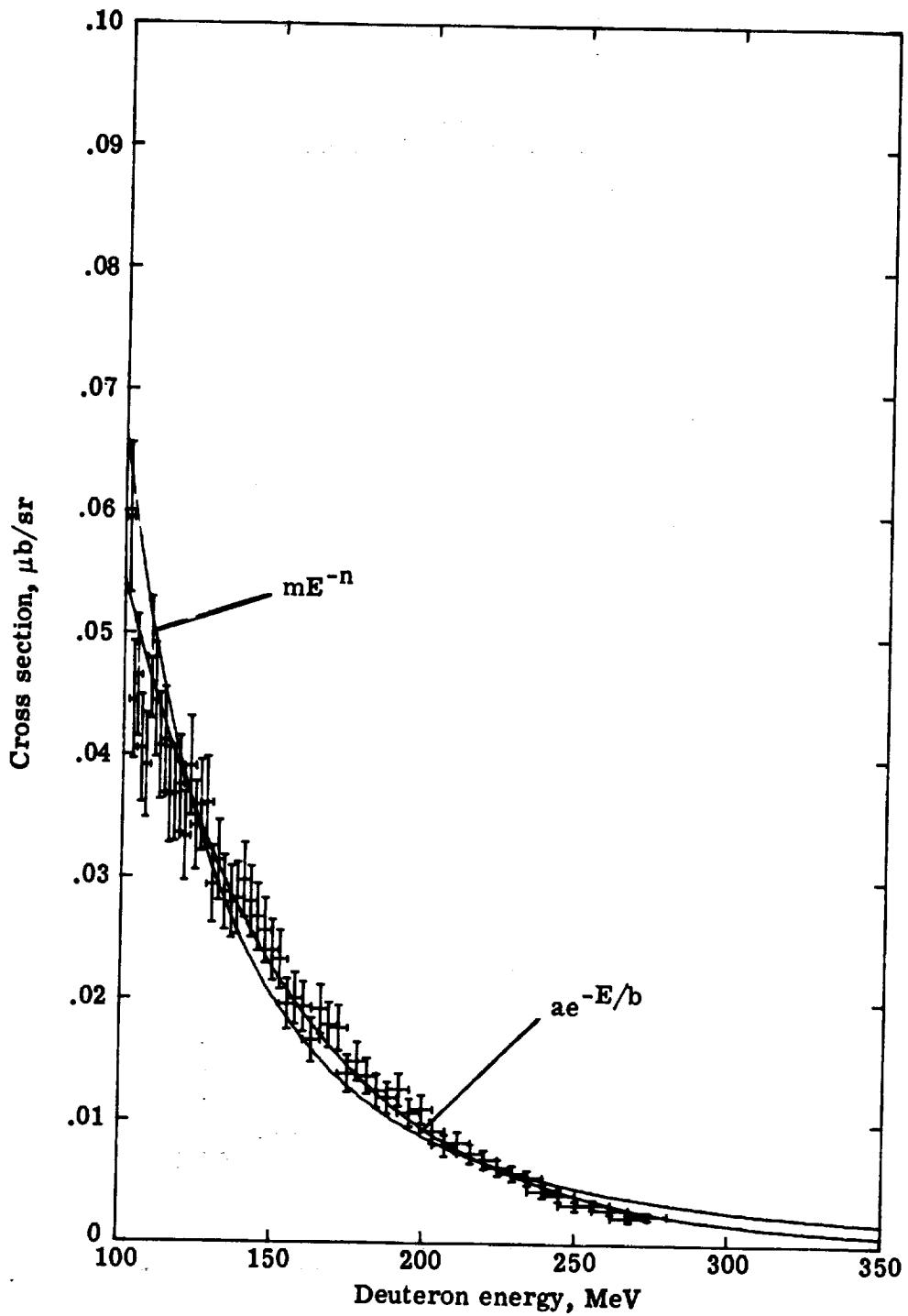


Figure 21.- Concluded.

